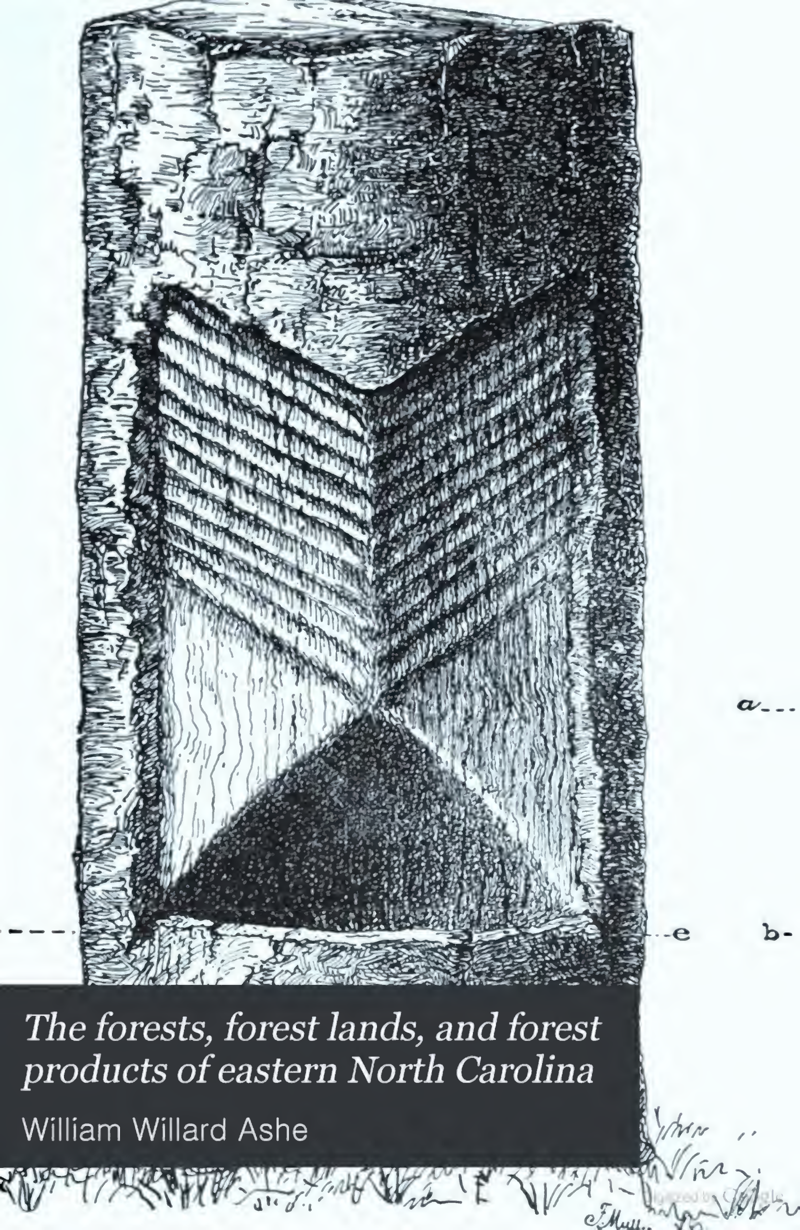

The forests, forest lands, and forest products of eastern North Carolina

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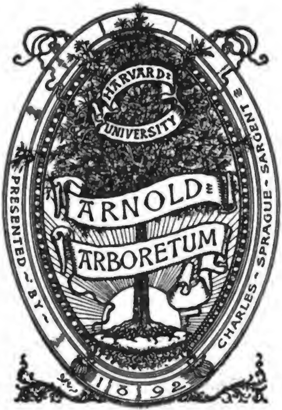

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NORTH CAROLINA GEOLOGICAL SURVEY.

J. A. HOLMES, STATE GEOLOGIST.

BULLETIN No. 5.

THE FORESTS, FOREST LANDS, AND FOREST PRODUCTS OF EASTERN NORTH CAROLINA.

BY

W. W. ASHE,

IN CHARGE OF FOREST INVESTIGATION.

RALEIGH:
Josephus Daniels, State Printer and Binder
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LETTER OF TRANSMITTAL.

RALEIGH, N. C., September 26, 1894.

To his Excellency, HON. ELIAS CARR,
Governor of North Carolina.

SIR:—I have the honor to submit herewith for publication as Bulletin No. 5 of the Geological Survey publications a preliminary report on the Forests, Forest Lands and Forest Products of Eastern North Carolina. This report has been prepared by Mr. W. W. Ashe, who is making for the Survey a careful examination of the forests of the State. I beg to call your special attention to two facts brought out in this report: (1) the continued and unnecessary destruction of the forests of our eastern counties by fires and stock, and the importance of remedying this evil before it is too late; (2) while we cannot at once greatly enlarge the areas of our turpentine orchards the quality and value of the naval store products may be increased to the extent of some $200,000 per annum by the adoption of the French system of gathering the turpentine.

I desire to express my appreciation of the active and encouraging interest which you and the other members of the Board have shown continuously in this and all other work undertaken by the Survey.

Yours obediently,
J. A. HOLMES,
State Geologist.

PREFACE.

The law inaugurating the Geological Survey provides for the investigation of the timber as well as the mineral interests of the State; and in carrying out this provision a systematic examination of the forests was begun in 1891 and has been carried on since that time. The plan adopted in this work embodies a fourfold investigation: first, as to the existing forest resources; second, as to how these resources can be utilized to the greatest advantage without involving the destruction of the forests; third, as to how the waste lands of the State can be continuously restocked with valuable trees, and thus our forest wealth perpetuated; and fourth, as to what can be done to encourage the development in the State of enterprises which will manufacture into finished products a larger portion of our timber instead of shipping to other States our crude materials for manufacture there. We have found, as will be shown in this Report and others which are to follow at an early date, that our forest resources are considerable; and they are now attracting lumbermen and capital from many sections of the country. The lumbering industry in the State is already a large one and is increasing in magnitude; indeed, already the timber is being cut with such rapidity that we may fairly ask ourselves the question, how long it will be before our forest wealth, like that of many other States, becomes a matter of the past. And we may also ask ourselves the question, whether it is possible that these resources can be utilized now and at the same time our forest wealth be perpetuated.

A trained student in forestry will answer this latter question in the affirmative, but the experience of the past has too often answered it in the negative. The cutting of the valuable timber frequently leads to the total destruction of the forest. The trees are felled regardless of surrounding growth that may be injured; and the branches and the tops are left scattered among the younger growth and thus add greatly to the destructiveness of forest fires, which frequently follow during the first dry season. The average lumberman has but one purpose in the prosecution of his work: the removal of the valuable timber. It rarely happens that the owner, himself, seriously considers the future welfare of his forests; and, indeed, the opinion seems to be prevalent in the public mind that when the valuable timber has been once removed from a forest the forest itself no longer has a value, and may as well be cleared away so that the soil can be cultivated; or, if it is allowed to remain, it is usually made to serve as a range for cattle, and is thought to answer this purpose best when burned through by the forest fires every autumn or spring.

The policy of the average citizen appears to be based upon the theory that our natural resources are inexhaustible, and that we should get all out of them we can to-day and let the future take care of itself. And so thoroughly grounded are these notions in our public and private policy that it is exceedingly difficult to secure the adoption of any plan which runs counter to them. But fortunately, in the matter of our forests, their preservation for use by a future generation need not prohibit the utilization of the valuable timber now standing by the present generation. It only demands that while we cut and make use of this timber we protect the young growth, and look to the restocking of our waste lands with valuable trees, and thus make the forest valuable for future generations also.

The examinations of the forests in Eastern North Carolina were begun by the present writer several years ago. More extended investigations have been carried on by Mr. W. W. Ashe at intervals during the past two years. The larger part of the information embodied in the present report was collected by him during a series of extended trips made through the eastern counties during the autumn of 1893 and the following winter. As shown in the body of this Report, the approximate supply of pine timber now standing in Eastern North Carolina is about 8,200,000,000 feet, and this is being cut at the rate of about 450,000,000 feet per annum. These figures point in unmistakable terms to the fact that, unless meanwhile we encourage the growth of new trees, two decades more will find the valuable pine forests of this region largely a thing of the past. And it is unfortunately true that the cutting of this timber is often followed by the destruction of the forest.

Indeed, nothing in the way of forest management could be more reckless and destructive than the treatment of our long-leaf pine forests during the past few decades. In the boxing for turpentine the trees have been cut so deeply and so extensively that both their vitality and strength have been greatly weakened, and the storms have prostrated many of the finest specimens. The lumberman and the storms have been followed by forest fires, which have completed the destruction, already begun in so systematic a manner, of large areas.

Started at times by thoughtless hunters at night, by sparks from an engine, by careless squatters or tenants, or even at times by land owners, in the hope of improving the grazing capacity of their lands during the following season, these forest fires sweep irresistibly across miles of territory, destroying not only the mature forest trees, but also the young growth; and thus destroy the forest of the future as well as of the present. And the few young pines which may have escaped destruction in this way soon follow the fate of the others by being destroyed by hogs. Many of these long-leaf pine lands which lie in the sand hill regions of Eastern North Carolina have had their forest removed so completely that they have become "waste lands," covered by a thin growth of nearly worthless scrubby oak. The total area of these waste lands is now nearly half a million acres, and is steadily increasing. This Report endeavors to show that while much of these waste lands are worthless for other purposes, they can be re-set with long-leaf pine forests if they can only be protected against forest fires and stock. And it is gratifying to find among the lumbermen themselves a growing realization of the fact that it is to their interest and to the interest of the public at large that this destructive policy give place to a more intelligent plan which, while it does not seriously curtail the utilization of the existing forests, it looks to their protection and perpetuity.

It is devoutly to be hoped that this awakening will grow into a change of both public and private opinion concerning the future of our forests, and lead to the adoption and carrying out of rational plans for their perpetuity and improvement. The problems connected with the accomplishment of this end will be discussed more fully in future publications of the Survey, now in preparation. The object of the present report is to describe briefly the present condition of the forests and forest lands of this region. The capital invested in the lumber industry in Eastern North Carolina in 1893 amounted to $4,690,000, and more than 8,000 men were regularly employed in connection with the 323 establishments. The market value of the forests products of this region for 1893, including naval stores, but not including fire-wood nor fencing material, amounted to $7,320,000. Including these latter items the aggregate annual value of the forest products of the region will probably reach $12,000,000. Certainly this is an industry the future maintenance of which deserves the earnest consideration of the State and her individual citizens.

The Survey is indebted to many lumbermen, naval store dealers and manufacturers, and to many other citizens in every part of this region for their kind co-operation in the work of collecting information for this Report, and I beg to assure them that their kindness and hospitality have been highly appreciated.

J. A. HOLMES,
State Geologist.

FORESTS, FOREST LANDS AND FOREST PRODUCTS OF EASTERN NORTH CAROLINA.

By W. W. Ashe.

CHAPTER I.

FORESTS AND FOREST LANDS.

OBJECTS OF THIS PRELIMINARY FOREST SURVEY.

During the present decade there has been a marked increase in the lumber industry in Eastern North Carolina and a corresponding decrease in the available supply of standing timber. Already predictions are numerous as to the exhaustion at an early date of the supply of merchantable long-leaf pine over considerable areas. The boxing of these pines weakens the trees and makes them more liable to be blown down by the winds, and far more liable to be destroyed by forest fires, which by their frequency and extent have entirely removed the long-leaf pine forests over many large areas. These pine forests, in the sandy regions, instead of being replaced by a valuable young growth of the same kind are followed by a worthless growth of sand black-jack oak. Forest fires and subsequent pasturing of these regions with cattle and hogs are the important agencies which combine to prevent the long-leaf pine from reproducing itself over the larger portion of these sandy lands. From these causes the extent of these areas of waste or abandoned lands is increasing steadily. It is believed that under proper management these waste lands can be restocked with long-leaf pine.

The present examination was undertaken with a view to determining the exact condition of the forests of the eastern section of the State, the rapidity with which they are being removed, the condition of lumbered districts, the character, extent and condition of the regrowth or "second growth," and to find out, if possible, some practicable plans for the protection, development, and extension of the forests of this region.

AREA UNDER CONSIDERATION.

The area examined embraces thirty-eight eastern counties and the eastern parts of six more, being what is usually termed the long-leaf pine belt in North Carolina. This is the "coastal plain region" of the geologists, which extends inland from the coast a distance of one hundred to one hundred and fifty miles and has in this State an aggregate area approximating 24,000 square miles. Its western border, separating the hill country from the coastal plain region, may be described as an irregular line extending through the western part of Halifax and the south-eastern part of Franklin county, passing near Raleigh and Cary to northern Montgomery and eastern Anson counties. Its surface is that of a gently undulating plain, of less elevation (ten to twenty feet above tide) and of a more nearly level surface eastward, becoming more elevated (three hundred to five hundred feet) and rolling along its western border. Its soil is generally a sandy loam or sand, though in limited areas clay predominates. In the more eastern portion of this region are numerous extensive swamps or marsh areas surrounding, in some cases, small lakes and bordering streams. In some of these the soil is mainly an admixture of sand and vegetable *mold*, while in others it is a fertile loam. The soil of the western portions of this region, north of the Neuse river, varies considerably, but is ordinarily a loam, becoming sandy or gravelly in some places and clayey in others, while south of Neuse river the sand predominates, and there are numerous elevated, dry, sandy ridges on which only the long-leaf pine and the sand black-jack oak flourish.

KINDS OF GROWTH.

The timber over the entire section is, on the highlands, largely of two species of pine, one, the loblolly pine (*Pinus Taeda* L.), more confined to the counties north of the Neuse river and to the moister soil; the other, the long-leaf pine (*Pinus palustris* Mill.), to those south of this river and to the drier, more sandy soil. Beneath these trees, where the soil is not too dry and sandy, is a lower growth of small white and post oaks, dogwood, haws and the narrow-leaved crab-apple, while where the soil is very sandy and dry there grows, either with the long-leaf pine, or where it has been removed, a small worthless oak, the sand black-jack or barren oak (*Quercus Catesbaei* Michx.), and less frequently the high-ground willow oak (*Quercus cinerea* Michx.). This oak is also a small tree and indicates the most barren soil. Besides the pines just referred to, there are two others found with them, the short-leaf pine (*P. echinata* Mill.), an uncommon tree except on dark loam or gravelly soil along the western and northern limits of this section, and the savanna pine (*P. serotina* Michx.), a knotty, unsymmetrical tree occurring from Virginia southward along the margins of "pine barren" ponds or scattered in small clumps over the open savannas and marsh lands. These few species form the chief growth of the higher lands.

The swamp lands, with a total area of about 3,500 square miles, have a very characteristic and varied growth. Bordering these swamps are water and willow oaks, with the evergreen loblolly bay and sweet bay; farther in them are huge swamp chestnut oaks (*Quercus Michauxii* Nutt.), elms, maples, beech, holly and tall rosemary pines (*P. Taeda L.*). These lands constitute the *oak flats*, areas which are under water only during the wettest seasons of the year. They have usually a good soil and can be easily drained.

Where the water is deeper in the swamps and remains longer grow the cypress, sweet gum, black gum, tupelo and yellow poplar.

In the mud swamps along the larger streams there are, besides cypress and gums, ash, overcup oak, cottonwood, sycamore and hackberry. Mixed with the other swamps, but covering less area and occurring only on sandy or peaty soil, are white cedar swamps, or "juniper bays," as they are usually called. The tree growth in these is largely and often entirely juniper or white cedar (*Chamaecyparis spheroidea* Spach.) and white bay (*Magnolia glauca* L.). In the extreme eastern part of this section, in the immediate vicinity of the sea-coast, there is a characteristic arborescent flora of red cedars and live oaks, while along its southern limits the palmetto and American olive (*Olea americana* L.) give it a semi-tropical aspect. On the other hand, as the clay and loam of the hill country is neared, the oaks and hickories rapidly increase among the pines, making the transition to the hardwood uplands.

While this does not exhaust the list, even of the useful trees of this section, it includes those of greatest importance and widest distribution, and those most characteristic of the region. Those, however, which at present are of greatest economic importance are the pines, cypress, white cedar. ash and yellow poplar, and these only will be considered in detail, as the other forest trees of this section are not yet subject to the destructive agencies which prevent the extensive propagation and even threaten the future existence of at least one of the most valued of these trees.

NOMENCLATURE OF THE FOREST TREES.

The names of many trees occurring in the State are very much confused, some trees having several names applied to them in the same locality, while in other localities the same name is given to several distinct species. This is particularly true of the pines of the eastern section, so much so that they frequently cannot be distinguished at all by their local names. Names which are in very general use, and the use of which will prevent confusion, are those adopted by the United States Forestry Bureau. These names will be used throughout this report and are given in the following table along with the corresponding botanical terms and a list of the other names generally used in this State, with the region to which they are peculiar:

LONG-LEAF PINE (*Pinus palustris* Mill., *P. australis* Michx.) is known everywhere by this name, but *long-straw pine* is a term frequently substituted for it, the leaves of the pine after they have fallen being always called "straw." *Long-leaf old-field pine* is the name given to the young growth in fields, etc. *Pitch pine* is used in the north-eastern counties and by turpentine distillers. *Heart pine, North Carolina pine, Georgia pine* and *yellow pine* are lumbermen's names.

LOBLOLLY PINE (*P. Taeda* L.) is a name rarely heard in this State in the field, *short-leaf* or *short-straw pine* being the usual name. *Long-straw pine* is heard in the north-east, where this tree grows with *P. echinata* (the short-leaf pine), and *rosemary pine* is used along the Cape Fear river. *Slash pine, swamp pine* and *old-field pine* are names frequently given to it. *Sap pine, North Carolina pine* and *North Carolina sap pine* are names in use among lumbermen.

SHORT-LEAF PINE (*P. echinata* Mill.).—*Short-leaf pine* and *yellow pine* are names given it in the middle and western sections of the State, and it is there also the *old-field pine*. It is *spruce pine* in eastern and south-eastern counties and is known among mill men as *North Carolina* and *yellow pine*.

SAVANNA PINE (*P. serotina* Michx.) is also called *short-leaf*, and other names for it are *old-field pine, bastard short-leaf, swamp* and *pocosin pine*. This pine is seldom recognized as distinct from the loblolly. Its most frequent designation where so distinguished is *pocosin pine*, from its growing in flat, marshy land; the flat, undrained lands, usually at the heads of streams, being called "pocosins." These pocosins are covered with a low growth of gums, this pine, and an undergrowth of gallberry bushes, huckleberries and andromedas, while in places there is more or less coarse, densely stooled grass and sedges. This land often appears to be on the point of becoming savanna land, should the drainage become more thorough or its surface be raised by an accumulating peat. The common names for the other trees of this region, which are being discussed as being at present of considerable economic importance, are widely known and merely deserve mention: *Cypress* (*Taxodium distichum* Rich.); *yellow poplar* (*Liriodendron tulipifera* L.); *white cedar* (*Chamaecyparis spheroidea* Spach.), often called *juniper*, a name that is also applied to a small shrub farther north. Although three species of *ash* occur no distinction is made between them, each being called simply ash. These three species are the *water ash* (*Fraxinus platycarpa* Michx.), *white ash* (*F. Americana* L.) and *red ash* (*F. pubescens* Lam.). The first of these is a small tree confined in this State to swamps in the extreme eastern and southern parts. The other two are larger trees and occur in all parts of the State, either in swamps, along streams or in moist, cool places.

ORIGINAL DISTRIBUTION OF THE PINES.

The distribution of the pines and the respective area occupied by each in this State has changed a great deal since the first exploration of the country.

LONG-LEAF PINE (*P. palustris* Mill.).—The distribution of no tree has been more affected than that of the *long-leaf pine* by the transformation from a wilderness to a civilized country. The long-leaf pine formerly extended over the entire area under consideration, growing upon the drier portion of the sand. In the southern and south-eastern counties it formed a forest of pine, unmixed with other trees, but in the northern and western counties it was confined to the sandy or gravelly drift along the higher and drier ridges, here intermixed with short-leaf pine and scattering oaks, while poplar and loblolly pine occupied the lowlands.

Early in the last century the production of tar and turpentine was a profitable industry north of Albemarle sound, the commodities being taken to Norfolk or Nansemond, Va., for market.* The crude turpentine was shipped to England and there distilled. The largest bodies of pine which then yielded turpentine were the one on "Sandy Ridge," lying to the north of Edenton, and another east of Chowan river, in Gates county, and extending north into Nansemond county, Va. Before 1850 these had ceased to be of economic consideration, such trees as had withstood the fires and wind having been converted largely into building material. Now only isolated trees are to be seen here, scattered among black-jacks on the highest land. That they ever occupied much of the land might be questioned but for the tar-kiln mounds with which these counties are studded, the land having now a heavy growth of loblolly pine, and the mounds even bearing trees of this latter species two or three feet in diameter.

Southward these pines occurred only scattered over the high, sandy land lying between Albemarle sound and Washington. Now a tree of this species is rarely seen here. Between Washington and Newbern on a high sand ridge, with an area of 35,000 acres, was the finest body of pine in the Pamlico peninsula, but there is now very little merchantable timber of this kind left on it. West of this body it occurred in Beaufort, Craven and Pitt counties, only thinly dispersed among the loblolly pines as far as Kinston in Lenoir county, where on a suitable soil it again became the dominant forest tree, extending west as far as Enfield, and nearly to Raleigh. On the maritime sand hills just within the sounds there was a narrow belt in Currituck county, and in Carteret a wider belt in the middle of the county, lying north and south, parallel to the coast. In Currituck it is now confined to the southern promontory which projects into Albemarle sound, and in Carteret there are only several million feet of mill timber on the sand ridges opposite Bogue sound. From Carteret southward there was some uniformity as to its manner of occurrence. It occupied a belt from two to twenty miles wide immediately on the coast; beyond that lay a poorly drained basin of variable width and broken contiguity, embracing oak flats and gum and cypress swamps. The long-leaf pine re-appeared west of this and extended in an unmixed forest, broken only by river swamp, streams and occasional "juniper bays," to its western limits at Cary to ten miles west of Troy, and to Lilesville in Anson county. It is in this stretch of country that the largest areas lie which are either partially or completely denuded of all valuable tree growth and where a future growth is being entirely kept down by the systematic burnings to which those lands are subjected.

---

*Wm. Byrd, Westover MS., Petersburg, Va., 1841, p. 27. (This manuscript was written in 1729).

South of North Carolina the long-leaf pine extends through Eastern South Carolina and Georgia, Southern Alabama and Mississippi, and west of the Mississippi river it re-appears in the sandy uplands of the valleys of the Red and Sabine rivers in Louisiana and eastern Texas, where it reaches its greatest development.

The quality of the wood of this pine varies considerably with the character of the soil on which it grows. Where the humus covering on the soil is thin, and the sand very deep, the tree has a coarser grain and a larger proportion of sap than where there is more organic matter in the soil, and it is not so highly silicious. The stocks with the coarser grain and larger amount of sap wood are distinguished as *pitch pine*, those with the finer grain and less sap wood as *heart* or *yellow pine*. The *pitch pine* yields turpentine more abundantly, can be worked for a longer time, and is less injured by repeated boxing and chipping. It is the more abundant in Onslow and Brunswick counties near the sea-coast, and on the highest sand hills of northern Bladen, Sampson and Cumberland counties. The *yellow pine*, containing mostly heart wood, makes the finer lumber and is the variety sought for by lumbermen.

LOBLOLLY PINE (*P. Taeda* L.) was originally confined to the lower and moister land, especially where it was loamy or slightly clayey, over the entire coastal plain region and westward beyond it about forty miles. While its limits have not materially changed it has increased its acreage, occupying now some of the higher and more sandy land, especially tracts which have once been under cultivation and much of the moister soil once completely or partially occupied by the long-leaf pine. Some original loblolly land which had a clayey or gravelly soil has been occupied by a heterogeneous growth of oaks, the white, post and black oaks and the black-jack being those that form the greater portion of the hardwood growth. As in the case of the long-leaf pine, the quality of the wood of the loblolly pine varies considerably with the different kinds of soil upon which it grows, and these variations in the wood and habit of the tree have given rise to the use of different local names which are applied by many persons throughout this region to what are considered by them different varieties of the "short-leaf pine," as the loblolly is commonly called. They are all, however, the same species (the loblolly pine) and their differences in quality of wood and appearance are due simply to dissimilarity of soil and other conditions which surround their growth. The principal kinds to which local names have been given are the following:

(1). The *rosemary pine* has a fine-grained (or sometimes coarse) wood, with a thin sap. It grows along the borders of deep swamps, or on mounds and hummocks within them, which are usually flooded during winter and spring. It grows with gums, cypress and ash, and is here the largest of the native pines, frequently attaining a diameter of 5 feet and a height of 130 to 140 feet, with a clear trunk of 80 to 90 feet. It has a bright brown bark broken into large, smooth, rectangular plates. It is found from

Virginia southward, the best developed trees recently observed being found on the Cape Fear river and its tributaries. South of the Cape Fear river they are not common. Some of these trees show on being cut that they are over 400 years old.

(2). The *swamp* or *slash pine*, which is the most frequent form of the loblolly, has a coarse grain, with the sap wood occupying half or even more of the diameter. The tree is smaller and the wood not so highly valued as that of the preceding, and is also said to decay more rapidly. It is most common on the moist or wet lands north of the Neuse river, where it forms a compact forest; and through this region and in the adjacent parts of Virginia it is the chief lumber tree.

(3). The *old-field pine* is a growth of the loblolly pine which is often looked upon in the south-eastern counties as a tree distinct from each of the preceding. It is, however, only a vigorous, exceedingly coarse-grained loblolly pine, which, having grown very fast, has only a small proportion of heart, logs 2 to 2½ feet in diameter rarely having one-fourth of their diameter heart. Of this open-grained wood both heart and sap decay rapidly on exposure to the weather unless painted or otherwise protected. But it is now being used very largely for indoor work, for which it is well adapted.

SHORT-LEAF PINE (*Pinus echinata* Mill.) is found mixed with hardwoods on all the dark, gravelly loam of the uplands and is there the chief lumber pine. In the eastern counties it was originally only scatteringly distributed, even in those adjacent to Albemarle and Pamlico sounds, where it was most abundant. From here it has been largely removed. South of Neuse river it was a rare tree, being found in small clumps interspersed among the long-leaf pines where the soil was inclined to be a dry or gravelly loam. Some trees on fertile soils become very large and have been removed for "tun timber." The wood of these larger trees is only a little coarser than that of the long-leaf pine; it is much lighter, though, and more brittle. On the sandy soil of the coastal plain region it does not abundantly reproduce itself, and young trees are uncommon, but on the uplands it is rapidly increasing and its young growth promises to play an extensive part in the future development of this section. As it has the smallest cone and shortest leaf of any pine in the eastern portion of the State it can be readily distinguished. This pine has a wide distribution, extending north to Massachusetts and west to Kansas and eastern Texas. It always occurs mixed with hardwoods or other pines.

SAVANNA PINE cannot readily be distinguished from the loblolly in young trees, but mature trees are easily separated. It is a medium-sized tree, whose trunk holds its size well, being covered with limbs and knots for the upper two-thirds of its height. The leaves are similar to those of the loblolly, but the bark is a darker brown and smoother. It is always covered with cones, which remain on for several seasons. These are shorter than the cones of the loblolly, conical, and usually have the scales closely oppressed. This species is of but little commercial value and is rarely used for the reason that the wood is coarse-grained and gummy, with a large proportion of sap wood, and the trees are frequently unsound. The savanna pine has been but slightly affected by the causes which have operated to increase or diminish the distribution of the other pines. Being sawn for lumber only by accident, and growing only on a few kinds of soil, and such soils as are unfit for agricultural purposes, the amount of it standing to-day is practically the same as formerly.

FORESTS AND FOREST REGIONS IN EASTERN NORTH CAROLINA.

The following descriptions of the counties of the coastal plain region show, in a general way, not only the quantity of merchantable timber now standing in the several counties, but also, when such figures were obtainable, the areas and character of such lands as have been lumbered. They also show the condition in which these lands were left after being cut over, and the kind of young growth which is succeeding the one removed, whether it be the same or a different kind, and give such tracts as have been burnt over after lumbering, on which the tender young growth and trees which might serve for seed trees have been partially or completely destroyed.

The acreage of the various kinds of timber, excepting the long-leaf pine, is prepared from information furnished by county officials, lumbermen and residents familiar with the lands of their respective sections. The amount of standing long-leaf pine is an estimate based on the number of barrels of rosin produced in each county, the unboxed round pine and the abandoned orchard also being taken into consideration. These figures were corrected in some instances by the estimates obtained direct from the acreage of standing pine, the figures for such acreage coming from county records which show the character of the timbered lands of the townships. Besides this a thorough personal examination was made of the condition of the timbered lands in different sections of each county.

The counties, beginning with those that lie nearest to the coast and proceeding inland, have been grouped according to the character of their dominant economic timbers as they stand at the present time.

THE SEABOARD REGION lies along the coast or but a short distance inland. It has an elevation of from 10 to 100 feet above the sea-level. Its average altitude, however, is not over 30 feet, and the only points which attain an elevation above 70 feet are a line of drifting sand dunes along the north-east coast, which in places are over 100 feet high.* The counties included in this region are Columbus, Brunswick, Pender, Onslow, Duplin, Carteret, Jones, Craven, Pamlico, Beaufort, Hyde, Dare, Tyrrell, Washington, Chowan, Perquimans, Pasquotank, Camden and Currituck. These counties have loblolly pine as the dominant forest tree, though in the most southern ones there is considerable long-leaf pine, and there are numerous swamps with a growth of sweet and black gums, cypress and white cedar.

THE INLAND LOBLOLLY PINE REGION, which lies along the Neuse river and north of it, farther inland than the seaboard, embraces the counties of Gates, Hertford, Bertie, Martin, Pitt, Greene, Edgecombe, Wilson, Lenoir, Wayne and Johnston. Their elevation is slightly higher than that of the seaboard counties, and will average between 100 and 150 feet, being higher toward their western borders. Their upland growth is nearly all loblolly pine, except that in Lenoir, Wayne and Johnston counties there is considerable long-leaf pine. There are few swamps except along the streams.

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*Geology of North Carolina, W. C. Kerr, Vol. I, 1875, pp. 13-19.

THE PINE-BARREN REGIONS.—The counties containing the larger portion of the pine-barren areas are New Hanover, Sampson, Bladen, Robeson, Cumberland, Harnett, Richmond and Moore. These lie south of the Neuse river and just west of the southern seaboard, excepting New Hanover, which is situated at the mouth of the Cape Fear river. The altitude of these counties varies between about the same limits which were given for the inland loblolly pine counties. Long-leaf pine or the sand black-jack, which has largely replaced it, is the characteristic growth of these counties.

THE TRANSITION REGION.—Nash, Halifax and Northampton counties form a tier of counties which are transitional between the loblolly uplands and the hardwood hills. These in their western portions have an altitude of from 200 to 400 feet, while their eastern portions lie at a lower level. They have no swamps except narrow strips of alluvium lowlands along the streams, which are subject to overflow. Montgomery, Chatham and Wake form another tier of transitional counties. They lie partly in the long-leaf pine belt and partly in the hardwood hill country. The western portions of these counties reach an altitude varying from 450 to 700 feet; but along the streams and in the more easterly portions their altitude is considerably less.

THE SEABOARD REGION.

BRUNSWICK COUNTY has in its western part 4,000 acres of white cedar land, most of it located along Juniper creek, Green swamp and its ramifications, and 20,000 acres of excellent cypress and loblolly pine lands which have never been lumbered. The lumbered districts lie in the northern part of the county along the W. C. & A. R. R. and in the northern arms of the Green swamp, which are tributary to the Cape Fear river. Much timber has also been rafted out by way of Waccamaw river from the extreme western part of the county to the mills at Georgetown, S. C. The oak lands bordering the numerous swamps are equal in area to the cypress lands and are destined to become very valuable. The entire swamp area is 166,000 acres, one-half of which is gum swamps and cane brakes. The cutting has been done gradually in these swamps and the young growth is in a fair condition. The long-leaf pine lands lie in the southern and central parts of the county and consist mostly of turpentine orchards either still being worked or now abandoned. There are in this county 130,000,000 feet of standing long-leaf pine.

COLUMBUS COUNTY has in its southern and eastern parts, along Waccamaw river and the lake swamp and in Green bay, some very fine cypress. These bodies have in part been lumbered. In White and Brown marshes and in the western section of the county, along Lumber river and Big swamp, there are large tracts of unlumbered cypress lands. The total area of cypress in the county is about 32,000 acres. In Green bay swamp, from which large quantities of white cedar have already been taken, there still remains a great deal more. There are 60,000 acres of swamp lands in the county. On the level pine flats there are between ten and twenty thousand acres of loblolly pine, largely second growth, very little of which has ever been cut. The long-leaf pine lands lying in the central and northern portions of the county have 145,000,000 feet of merchantable pine standing on them.

DUPLIN COUNTY contains about 12,000 acres of cypress swamp along the North East river and its tributaries. Adjacent to the streams much of the best timber has been culled or picked over. The remaining merchantable cypress lies principally along North East river, Back swamp, Goshen, Lockwood and Cypress pocosins. There are excellent water oak, willow oak and swamp chestnut oak in the flats bordering the above-mentioned swamps and Angola bay. There is some ash and yellow poplar, but the wood of neither tree is here of a superior quality. Over one-half of the swamp area, which amounts to about 38,000 acres, is covered with compact forests of black and sweet gum and tupelo. The loblolly pine, which is largely second growth, occupies about 50,000 acres. There is still some rosemary pine on the more fertile lands around the smaller swamps. The quantity of standing long-leaf pine is not large, only 68,000,000 feet. This county and Pender have furnished a great deal of timber for the Wilmington mills.

PENDER COUNTY.—Several of the swamps of this county are continuations of the swamps of Duplin which lie along the North East river. Besides these there is Holly Shelter swamp, a large swamp in the eastern section of the county and extending into Onslow county. There is altogether 15,000 acres of cypress land, one-third of which has been culled, the largest and finest trees having been cut out to make drawn shingles from them. The finest cypress is located in Holly Shelter and the North East river swamp. Angola bay, lying partly in this county and partly in Duplin, covers 120,000 acres. Through this swamp there are extensive areas which have a very poor, sandy soil and are covered only with reeds and brambles and the savanna pine. There is a considerable area of water oak and swamp white oak flats bordering the swamps. The swamp area is about 160,000 acres. The loblolly is largely second growth and occupies the flat pine lands of the middle section. There are 90,000,000 feet of long-leaf pine standing in the county.

ONSLOW COUNTY.—Although this county has a very large swamp area, over 100,000 acres being swamp, only about 4,000 acres of it, consisting of narrow strips along the streams, can be called cypress land. Both White Oak swamp and Holly Shelter swamp are fringed with a broad belt of swamp white oak and water oak flats. At least one-third of these swamps is "gladey," being covered with gallberry bushes, or cane brakes and a scrubby growth of savanna pines, and has a soil of sand that is exceedingly barren of fertility and forests. There are no extensive areas of heavily timbered gum swamp in the county. Loblolly lands, covering 58,000 acres, occupy the greater part of the center of the county, while the long-leaf pine lies chiefly in the north-western part. There are 60,000,000 feet of the latter standing. The sand hills adjacent to the coast, formerly covered with long-leaf pine, are now almost denuded. In parts of the county near the coast there is a scattering growth of red cedars. They are, indeed, in this and Carteret counties more abundant than in any other portions of the State, but are generally found in considerable numbers on all the "banks" and islands skirting the coast. White cedar occurs in several "bays" in the western section of the county, and forms the growth of a "bay" of considerable size near the source of White

Oak river. The loblolly and cypress have been removed to a large extent from the territory drained by White Oak river. Lumbering has only lately begun, however, in other parts of the county.

CARTERET COUNTY.—There is now found in Carteret county scarcely any cypress suitable for mill purposes. The loblolly pine area is about 30,000 acres, over one-half of which have been lumbered. In southern Carteret, near the coast, there are 20,000,000 feet of long-leaf pine, all consisting of timber standing in abandoned orchards. In the eastern section of the county there is an open pocosin of 80,000 acres, bordered with oak flats, but farther in only poorly timbered with savanna pine or in places entirely open.

CRAVEN COUNTY.—Although extensive lumbering has been carried on in this county for over half a century it has large tracts of second growth of loblolly forest which have never been cut into. The long-leaf pine was first removed and was rapidly replaced by the loblolly pine, except on the high, sandy lands lying north of the Neuse river. Most of the lumber now manufactured in the county is from this latter pine, although for some mills the savanna pine furnishes a great many logs. There are nearly 200,000 acres of swamp in the county, the Dover swamp, lying in the south-western section, having an area of over 120,000 acres. This swamp is sandy, and in the interior is covered with an open growth of the savanna pine and occasional cane brakes. It has been partially lumbered., The other swamps are fringed with swamp chestnut, oak or water oak flats, which have never been cut into. Besides the swamp lands there is a great deal of loblolly pine land south of the Neuse, which has been more or less cut over. North of the Neuse the loblolly pine lands are in about the same condition as on the southern side. There are in the county probably 38,000 acres of unlumbered loblolly pine land. The supply of cypress and ash in the river swamps is nearly exhausted, Swift creek and Trent river being now the principal sources of supply.

JONES COUNTY lies between Craven and Onslow counties and is penetrated by some of the largest swamps in this region. Dover swamp lies in the northern part of Jones, and White Oak swamp covers a large part of the territory south of the Trent, which flows through the center of the county and with its tributaries drains nearly its entire area. In the extreme eastern part lies the great pocosin of which Catfish lake is the center. This pocosin, extending eastward, occupies under different names much of the territory of southern Craven. All of these swamps in their interior have considerable tracts of land entirely untimbered, or covered with scattering savanna pines, small maples and gums, and have a large, unproductive soil of silt. They are, for the most part, bordered by extensive oak flats, though around White Oak swamp there are still large quantities of yellow poplar, ash and cypress. The cypress along the Trent river has been largely removed. The entire swamp area in the county approximates 125,000 acres. Excepting some narrow strips of sand hills lying parallel to the Trent river, which have a few million feet of long-leaf pine on them, the rest of the county consists of flat, loblolly pine lands, which have been largely cut over. There are between 25,000 and 30,000 acres, mostly lying in the western part of the county, yet in a virgin state. This county yearly supplies several million feet of logs for the mills at Newbern.

Pamlico county has 3,000 acres of white cedar swamp, partly lumbered, lying near Vandemere and along the western edge of Big Gum swamp in the northern part of the county. There are 7,000 acres of cypress swamp, over half of which are lumbered. This cypress swamp lies near the mouth of Bay river and in Gum swamp. The remaining swamp area is heavily timbered with yellow poplar, gums, chestnut oaks and water oaks. The soil of these swamps, though inclined to be peaty, is exceedingly fertile. The loblolly formerly covered all the rest of the county with the exception of a narrow strip of high, sandy land in the north-western section, which, in the character of its soil and the kinds of trees which grew on it, approached the pine barrens. There is now, however, no merchantable long-leaf pine in the county and not more than 10,000 acres of loblolly pine suitable for milling purposes. The central part of Big Gum swamp is open, covered with scattered savanna pines and an undergrowth of gallberries, huckleberries, brambles, etc.

Beaufort county.—There is some cypress along Chocowinity, Blount and the other streams of the county, but the supply is rapidly being exhausted. The loblolly pine, which had an original area of over 100,000 acres, has been largely removed except in the north-eastern section. Much of the best oak in the county has been converted into staves for the West Indies trade.

THE PAMLICO PENINSULA, consisting of the counties of Hyde, Dare, Tyrrell and Washington, is largely swamp, having over 1,000,000 acres of swamp in it. The uplands consist of narrow strips surrounding the swamp and land which has been drained around lakes Phelps, Pungo and Mattamuskeet. Around the eastern edge of the swamp and enclosing the sound is a narrow strip of treeless sand dunes. Much of the soil of the swamp, especially in Dare, Hyde and Tyrrell, is peaty and covered with a growth of white cedar and bays. There is estimated to be about 40,000 acres of white cedar now in the swamp. The cypress acreage is not near so large as formerly, but there is still a large amount standing. The largest bodies lie in Tyrrell and Washington counties. The cypress lands, too, are the most fertile, and have to a large extent been drained and put under cultivation. Along the outer edges of the swamps are oak flats, which in Hyde are very extensive.

The northern portions of Dare, Tyrrell and Washington, bordering on the sound, have a growth largely of loblolly pine with some oak lowlands. The standing pine has been removed from over half of this area, which is about 100,000 acres. In western Dare there are also extensive tracts of pine lands which extend into Beaufort county. Much of the swamp in Washington and Tyrrell counties is thinly timbered with the savanna pine. There is a great deal of soft maple and yellow poplar scattered through the swamp, and in places on the most fertile soils are considerable quantities of hickory, both the shag-bark and white-heart hickory. Lumbering has been one of the leading industries of these counties for a great many years, the numerous canals and streams which penetrate the region affording great facilities for removing timber.

THE COUNTIES NORTH OF ALBEMARLE SOUND are so similar in the character of their forests and soil, and are so closely connected with each other, that they can best be described as one body. Five counties occupy this territory, *Chowan, Perquimans, Pasquotank,* *Camden* and *Currituck*, lying from west to east in the order named. All except Chowan are penetrated in the northern parts by the Dismal swamp, or arms of it which lie on the boundary between this State and Virginia. About 65,000 acres of Dismal swamp area lie in these counties. Although the swamp varies a great deal in character of soil, most of it is peaty and was formerly covered by a heavy growth of white cedar. All of this cedar swamp has been lumbered, except about 8,000 acres, and about 8,000 acres have been repeatedly burnt over, effectually destroying all trees, and in places burning out the soil to a great depth. There were some narrow tracts of cypress in these swamps, and also in the swamps along the streams, but the cypress, like the white cedar, has been largely removed. These streams rise in the Dismal swamp and flow southward, cutting this territory into long divisions, forming the natural boundaries of the counties and convenient water-ways for removing timber along them. Oak was at one time abundant, but the finest has been cut out for staves and to supply the Norfolk navy yards. The finest pine also was removed many years ago for use in the navy yards.

The construction of two canals, the numerous natural waterways, and later a railroad crossing these at right angles, associated with the nearness of Norfolk and the facilities offered there for the shipment and marketing of lumber, had, as early as 1850, built up a large trade in timber and lumber from these counties. The lumber which is now manufactured is almost entirely from the loblolly pine. During the past decade there has been shipped from this section in the log over 800,000,000 feet board measure, while nearly as much more has been sawn by local mills; but such is the wonderful recuperative power of the loblolly pine forests on a suitable soil that now there remains not less than 25,000 acres of merchantable pine. The production of timber in these counties is, however, not one-half of what it was ten years ago, and sooner or later the annual output will be reduced to the increase in the forest by the growth each year.

These regions around the Dismal swamp were about the southern limits of the economic distribution of the holly, the trees reaching here a large size. Large quantities of holly, dogwood and soft maple have also been removed, but there is still a great deal left. Some sandy ridges near the middle of these counties were once covered with long-leaf pine, but there are scarcely any trees of it left now. The area of these counties is 750,000 acres, over 95,000 of which are in swamps. The savanna pine is found at intervals through the swamps, and extends into Southern Virginia, as does the tupelo gum. Some of the cypress lands are largely timbered with gums. The soil, for the most part, is sand or a sandy loam, but in the Dismal swamp, where it is not peaty, it is usually composed of fine silt. The timber lands of these counties have, as a rule, been more thoroughly lumbered than any others in the State.

THE INLAND LOBLOLLY PINE REGION.

GATES COUNTY, like the region just described, lies on the Virginia line, and has the extreme eastern part lying in the Dismal swamp. The Chowan river, which forms the southern and western boundary of the county, has along its entire course a narrow swamp. There are 20,000 acres of white cedar lands in this swamp and several thousand acres in the Dismal swamp which are untimbered. The little cypress still standing in the county lies along Bennett's creek. Loblolly pine, which occupied the central and eastern parts of the county, growing on a sandy loam, has been removed, except between ten and twenty thousand acres which are in small tracts. In the western part of the county is a high sand ridge resembling the pine barrens. The long-leaf pine has been removed from this and an open growth of loblolly and short-leaf pine with black-jack beneath them has taken its place. In the extreme north-western portion there is a strip of bright-colored loam soil, timbered with a heavy growth of post, black and red oaks. Most of the timber cut from this county is transported to Virginia.

HERTFORD COUNTY is the first of a number of counties lying in the pine uplands which has no large swamps. The eastern and southern parts of the county have a sandy loam soil, in places silty and very compact, which was covered with a dense loblolly pine forest, now largely lumbered, through which were interspersed narrow strips of white and red oak lands. In the northern part of the county there is more oak and dogwood mingled with the pine.

There are about 25,000 acres of unlumbered loblolly pine land. The cypress, which is confined to the alluvial land along the streams, is more abundant along the Ahosky and Pottecasy than any other streams.

BERTIE COUNTY has a soil and growth similar to those of Hertford county, consisting for the most part of upland loblolly pine lands. In the southern part, however, it is skirted by the Roanoke river, which is bordered with a broad swamp still having large quantities of white and red oaks, gums, maple, cottonwood, hickory, sycamore and elms and some ash and cypress in it. There is also some cypress along Cashie and Roquest creeks. Although the timber yield of this county has been very large for a number of years there are now standing 65,000 acres of unlumbered loblolly pine. Early in this century Bertie county was known as the "pine forest," on account of the density and excellence of its forests of this tree.

MARTIN COUNTY lies south of Bertie on the opposite side of the Roanoke. Its soil is similar to that of the last described counties, but the Roanoke river swamp is less continuous, being confined to several bends in the river in the eastern part of the county. Along the river there are some narrow sand ridges, now covered with black-jacks and small post and red oaks. The remainder of the forest area is loblolly pine land, about two-thirds of which has been cut over. The county is the seat of extensive milling operations.

PITT COUNTY, being drained in the northern and eastern parts by the Tar river and Grindle creek, one of its largest tributaries, has for many years furnished large quanties of timber for the mills at Washington. Along all the streams are large stretches of cypress swamp and oak lands, the latter forming virgin forests and the former only partially lumbered. The loblolly pine near the larger streams has been extensively cut. In the southern and western sections the soil becomes more sandy, and the original growth, long-leaf pine, has been replaced by loblolly pine, mixed with a low growth of oaks. The loblolly has never been removed from this section.

GREENE COUNTY, which lies just south of Pitt, has in the northern parts a soil similar to that of the adjacent portion of Pitt, and is covered with similar forests. In the southern section the soil is more sandy and there are numerous sand hills, approaching the pine barrens, now nearly denuded of the long-leaf pine, which was once abundant, and largely covered with sand black-jacks. Along Contentnea creek and its numerous tributaries, which drain the entire county, are extensive tracts of cypress swamps. In the northern part of the county these swamps, which extend over into Pitt, have been but little lumbered; in the central portion, however, exploration has been carried farther. About one-half of the forest lands, or 30,000 acres, is still covered with merchantable loblolly pine.

EDGECOMBE AND WILSON COUNTIES lie west of those last described and have an average elevation of about 50 feet higher than that of these counties. Their soil is considerably drier and more sandy than that of the section to the east of them, being a sandy loam, which in places passes almost into sand. The long-leaf pine, which primarily occupied these lands, has been largely destroyed and a scattering growth of loblolly pine, with an undergrowth of low post and red oaks and dogwood or thickets of black-jack oak, have taken its place. There are along the streams occasional strips of cypress swamp which have not been lumbered and there is a considerable quantity of other swamp timber, sweet and black gums, tupelo, soft maple, and occasional overcup and chestnut oaks. Although over one-half of the area of these counties is under cultivation, there is still standing a considerable quantity of merchantable loblolly pine.

WAYNE, another of the loblolly pine counties, has in the section contiguous to Wilson county a soil and forest similar to those of Wilson, but south of the Neuse river, which flows through the centre of the county, there are extensive tracts of pine barrens, stripped of pine and covered with sand black-jack oak or completely denuded. Skirting the Neuse river and its tributaries are tracts of swampy alluvium, on which there are still merchantable gums and oaks, and in places cypress and ash. The loblolly pine (rosemary), which was once abundant along these lands, has for the most part been removed. There are several small white cedar "bays" at different places in the county. The loblolly pine, except that along the streams, is all second growth and forms open forests. About one-fifth of the wood land, or 30,000 acres, is loblolly pine fit for mill timber. When removed this loblolly pine is apt to be succeeded by small oaks. There are now standing in this county probably 30,000,000 feet of scattering long-leaf pine.

LENOIR COUNTY is situated on the Neuse just below Wayne, and its swamp lands along the Neuse are of the same character and in a similar condition. The extreme southern and western parts of the county are very sandy, and in places on the ridges there are important bodies of long-leaf pine, or black-jack oak, which in places has replaced it, while between the ridges there lie very narrow alluvial or peaty bottoms covered with a growth of swamp timbers. Scattered through the county are plains, at times inundated, on which there is a growth of oaks, maples, elms and ash. The eastern section is flat loblolly pine land covered with a heavy growth, except near the river; but there are scattered through this loblolly pine forest small pocosins covered with savanna pines and a variety of shrubs. There are about 30,000 acres of loblolly pine and 30,000,000 feet of standing long-leaf pine in the county.

JOHNSTON COUNTY lies west of Wayne and is also drained by the Neuse. Along the river and its numerous tributaries there are the usual strips of swampy alluvium covered with swamp timbers. In the eastern and southern parts of the county the soil is a sandy loam, which becomes more loamy toward the north and west, and the surface in these sections is more rolling and hilly. The timber on this loam consists of long-leaf pine, mixed with oaks and loblolly pine, and in the southern section near the river there are quantities of valuable loblolly pine. There has been very little milling done in the county, but considerable timber has been rafted to mills down the river. The long-leaf pine is being very rapidly replaced by the loblolly pine, the amount of the former now standing being only about 160,000,000 feet.

THE PINE-BARREN REGION.

IN ROBESON COUNTY there is along the dark loam lands of the Lumber river 28,000 acres occupied exclusively by the loblolly pine. This pine is in all stages of growth, and is gradually taking the place of the long-leaf pine as the latter is being destroyed by forest fires or otherwise. Many of these tracts covered with loblolly pine appear, however, to have always been occupied by this tree which here forms, on soil sufficiently moist and loamy, small clumps of unmixed growth frequently 100 acres or more in extent. These trees are coarse-grained, largely of sap wood, and are from two to two and one-half feet in diameter. None of these have ever been cut for lumber. In Big swamp there is probably 5,000 acres of loblolly pine, which is largely of the *rosemary* variety, mixed with large gums and cypress trees. Only a part of this swamp has been lumbered. The area of the gum and cypress swamps is about 30,000 acres, lying in Big swamp and its tributary marshes, Flowers swamp and the other swamps along Lumber river. There has been very little lumbering done in them. There are no extensive oak flats in the county and little ash or poplar. On the long-leaf pine uplands, lying in the southern and northern sections of the county, there are 280,000,000 feet of merchantable timber. The pine lying immediately along the railroads has been to a large extent removed.

BLADEN COUNTY has about 12,000 acres of cypress land lying along Brown marsh, Big swamp, Cape Fear river, Colly and Turnbull creeks. About 4,000 acres have been more or less thoroughly lumbered; and there are about 3,500 acres of white cedar swamp, which have to a large extent been cut over, but were left in a fair condition. This latter lies in Big Juniper bay and various smaller bays on the north side of the Cape Fear. There are large tracts of untouched oak flats and gum swamps mostly in the southern and western parts of the county. Good ash, except in the smaller swamps, is becoming scarce. This county has a swamp area of about 55,000 acres. The loblolly pine, except along the swamps, is usually scattering. There cannot be less than 10,000 acres occupied by this pine, only the finest and largest trees having been removed. The long-leaf pine lands of Bladen have been very badly treated. On either side of the Cape Fear river there are extensive tracts of "pine barrens," on which this pine has been very largely destroyed, so that it is really waste land. But there is still about 308,000,000 feet of standing long-leaf pine, lying chiefly in the western and southern parts of the county.

NEW HANOVER COUNTY lies immediately on the coast, and consists largely of pine barrens. The long-leaf pine has been for the most part removed or destroyed. There are still, however, several million feet standing in different parts of the county. In the northern part along the North East river there is some swamp land timbered with gums and some oak. Smith's island, which lies at the southern extremity, is densely timbered with a growth of hardwoods, largely water and live oaks, interspersed with palmettos.

CUMBERLAND COUNTY, like the northern part of Bladen, lies largely in the sand-hill region and contains considerable areas of "pine barrens," from which the original long-leaf pine forests have been removed. In the eastern part of the county there is some white cedar along the streams or occupying small swamps, and along most of the deeper streams there is cypress. There are no extensive bodies of merchantable oak or loblolly pine to be found. In the eastern part of the county the long-leaf pine has been largely cut out, but west of Fayetteville it forms extensive forests, extending nearly to the Moore county line; and there are probably 310,000,000 feet of standing long-leaf pine in this region.

HARNETT COUNTY is situated north of Cumberland, and that part of it lying south of the Cape Fear river, which divides the county into northern and southern halves, is a continuation of the rolling sand-hill country with its pine barrens of Cumberland county. The larger part of these pine lands is in an exceedingly bad condition, having been burnt over until there are extensive tracts entirely denuded of all tree growth. There is very little cypress to be found in the county. North of the Cape Fear river the country merges into the dark loam uplands covered with a young growth of oaks, dogwood and loblolly pine, which are replacing the long-leaf pine. There is only about 200,000,000 feet of long-leaf pine now standing in the county. Harnett county furnishes some timber for the Wilmington market, last year it having been estimated that about 1,500,000 feet, board measure, of long-leaf pine timber was rafted down the Cape Fear river.

SAMPSON COUNTY.—The oak lands of Sampson lie in the northern part of the county and are covered with a growth of young white and post oaks. There are no large bodies of water or chestnut oak flats. The cypress and gum swamps lie in narrow strips along Black river and Big and Little Cohary creeks. The unlumbered cypress lands cover about 3,800 acres, and about an equal area has been cut over to obtain timber for the Wilmington market. The long-leaf pine lies chiefly in the southern and central parts of the county. The standing pine amounts to about 330,000,000 feet. The loblolly pine, largely second growth, is scattered through all sections of the county and occupies about 35,000 acres. This county has for many years furnished a large part of the timber that is carried to Wilmington.

RICHMOND COUNTY.—The larger portion of this county may be described as being typical sand-hill country, the surface being undulating and even hilly, and the soil sandy; the sand often being many feet deep. In the extreme western part there is along the Pee Dee a narrow strip of alluvial swamp, heavily timbered with red, overcup and chestnut oaks, red maple and hickory. In the eastern part of the county there are white cedar, gums and cypress of inferior quality along the streams. The long-leaf pine which covers the remainder of the county has, over the larger areas, been removed when adjacent to the railroads. Lumbering is, however, largely carried on in the northern part of the county at the present time, and extensive bodies of timber still remain there and in the eastern section. There remains probably 220,000,000 feet of standing long-leaf pine.

MOORE COUNTY lies north of Richmond and has in the southern part, along the sand hills, a similar soil and topography. This section, embracing the southern two-thirds of the county, is covered with long-leaf pine and is the seat of the largest long-leaf pine industry in the State at the present time. In the middle portion of the county, where the soil is more loamy, there is considerable post oak and small hickories mixed in with the pine along the hill-sides and yellow poplars and a few loblolly pines along the lowlands. The northern third of the county has a loamy soil covered with a growth of hardwoods mixed with long-leaf and short-leaf pines. Although extensive lumbering operations have been carried on in these pineries for the past fifteen years, so that all timber near existing lines of railroad has been removed, there are probably 320,000,000 feet of long-leaf pine still standing in the county. The long-leaf pine is succeeded in this county, as is the case in Richmond, by sand black-jack oaks. In the very sandy parts of the county there is only a little loblolly pine, with small cypress trees and some white cedar scattered along the streams.

THE TRANSITION REGION.

NORTHAMPTON COUNTY is situated on the boundary between the loblolly pine uplands and the hardwood hills which cross the western third of the county. The loblolly is mixed in places with scattered short-leaf pine, and is, except along the swamps and streams, very largely a second growth. It has never been lumbered. The southern and western boundary of the county is the Roanoke river, and along its entire course there is a strip of alluvial swamp from one to three miles wide, covered where there have been no clearings made with a heavy growth of trees similar to that along the same river in Bertie county (p. 20).

HALIFAX COUNTY.—The eastern half of Halifax county, like the greater part of Northampton, is a fairly level region, with an average elevation of but little more than 100 feet above sea-level. The soil is generally a sandy loam, and the forests of this region consist mainly of loblolly pine with the short-leaf pine, post oak, spanish and white oak interspersed. On the northern boundary of the county along the Roanoke river lowlands, which are of less extent on this side of the river than on the northern side in Northampton county, are at intervals forests of black gum, sweet gum, red maple, elm, red oak, ash, sycamore, hackberry, and other deciduous trees. Occasionally one finds on portions of these fertile lowlands, the cultivation of which ceased some fifty years ago, vigorous but scattering black walnut trees nearly 2 feet in diameter and more than 50 feet high. Beech creek, likewise, with its larger affluents, Marsh and Beaver Dam creeks, have along their courses some ash, cypress, gums and tupelo, and these streams are bordered in places with extensive flats of scarlet, chestnut, overcup and willow oaks. The western half of the county is quite hilly, as are also the western portions of Northampton and Nash counties. The soil, while sandy, gravelly and pebbly in places, is in general much more clayey than that of the eastern section. The forests of this western half of the county are mostly oaks, hickories and other hardwood trees, with a few scattering short-leaf pines.

NASH COUNTY has a soil and topography much resembling those of eastern Wake, being a rolling country, hilly along the larger streams and having a light loam soil. The growth, also, is like that of Wake, consisting of scattered long-leaf pines, about 20,000,000 feet, board measure, standing, which is rapidly being replaced by loblolly, or on close soils by oaks, dogwood and hickories. The long-leaf pine extends west to the clay hills; on which the hardwoods of the uplands are mixed with short-leaved pines. There is more loblolly pine here than in Wake, both original growth and second growth. There has been very little lumbering done in the county except immediately along the lines of the railroads.

MONTGOMERY COUNTY, lying west of Moore, has in the eastern part, on a loam soil, a heavy growth of long-leaf pine which has never been lumbered. This growth toward the middle of the county is mixed with short-leaf pine and hardwoods, and there the hardwood uplands begin. This is the finest body of pine for lumber now in the State, having been worked for turpentine for only four or five years. There are 338,000,000 feet of long-leaf pine in the county and about 40,000,000 feet of short-leaf. There are some extensive bodies of hardwoods in the Uwharrie mountains in the western section.

CHATHAM COUNTY now has an inconsiderable amount of long-leaf pine in the extreme south-eastern section. Its place has been taken as it was removed by a heterogeneous growth of oaks and the short-leaf pine. In the middle part of the county there are along the ridges short-leaf pines and hardwoods, while the lowlands along the Haw and the Deep rivers are timbered in most places with oaks, maple and loblolly pine.

WAKE COUNTY has in the eastern part considerable long-leaf pine still standing, mixed with a young and vigorous growth of oaks and dogwood. The soil is for the most part a reddish loam, interspersed with sandy ridges, on which the long-leaf pine, where it has not been replaced by black-jacks, is more abundant than on the loam. There are 30,000,000 feet of this pine standing. East of the center of the county the short-leaf pine appears, and from there westward it is the commonest old-field pine. There is a very large acreage of both second growth short-leaf and loblolly pines in the county and probably 60,000,000 feet of their original growth standing in the eastern section. To the north and west of Raleigh the surface is more broken and the oak growth more abundant, except along the gravelly ridges, where there is short-leaf pine. West of Wake the loblolly pine becomes less frequent.

EXISTING SUPPLY OF TIMBER IN EASTERN NORTH CAROLINA.

In conclusion, it can be said that certain kinds of timber, both useful and abundant, are as yet of little commercial importance in most parts of the coastal plain region. Such are water, willow, overcup and chestnut oaks, sweet and black gums, soft maple and sycamore. The supply of some other kinds of timber, such as ash and holly, has been nearly exhausted.

There are still large quantities of *cypress* standing in some counties, while in others the supply has been almost exhausted. This tree is of very slow growth and shows little tendency to reproduce itself abundantly, the regrowth after it has been removed generally being sweet and black gums. The soil of cypress swamps is usually one of the best of swamp soils and when drained is very productive; so these swamps are being put under cultivation. Considerable areas have already been reclaimed for agricultural purposes, and a great deal more is to be thus reclaimed in the near future. It is evident from this that in this State there will never be any general second growth of cypress to take the place of that which is now being removed.

White cedar, which usually occurs with white bays in small swamps or in clumps in other swamps, flourishes only on a peaty or very sandy soil which is largely mixed with organic matter. These soils are unfit for agricultural purposes and their fertility is easily destroyed by fire during very dry seasons, especially where the dried *debris* resulting from logging fills the woods. Unless these swamps are burnt out a growth of the same species is most likely to replace the white cedar after lumbering, but in the event of a fire the white bay (*Magnolia glauca* L.) will succeed and usually retain possession. Although white cedar is very valuable, grows rapidly, and there is only a comparatively small amount in the Eastern United States, these swamps are from carelessness frequently burnt and the chance of a regrowth thus destroyed.

The *loblolly pine*, now generally recognized as a valuable lumber tree, is the dominant pine over a large area, and has been removed from only a relatively small part of the territory it occupied. It is a tree of rapid growth which seeds abundantly and usually follows itself after lumbering. Oak occasionally replaces it as the hardwood uplands are neared. However, on account of the destruction of a great part of the young growth, these second growth forests are never as dense as they should be. This produces less timber to the acre and is the cause of many deformities, as knotty, crooked and short-stemmed stocks. The loblolly pine is also taking the place of the long-leaf pine in the forest on moist soils, and on drier soils when the latter have been under cultivation. The standing merchantable loblolly pine can be said to cover about 1,150,000 acres in the eastern part of the State. Allowing a cut of 4,000 feet, board measure, to the acre, this will make 4,600,000,000 feet of standing loblolly pine. At the present rate of cutting, 290,000,000 feet, board measure, having been reported as cut during 1893, this would last fifteen years. The final amount cut will, however, be much larger than this, since in the meanwhile there will be a constant increase each year in the amount of young growth available for milling purposes and a considerable increase in the size of the merchantable pine now standing. The entire acreage of loblolly pine land, including the lumbered areas with second growth on them, the unlumbered and lands where it is taking the place of the long-leaf pine, is considerably over 4,000,000 acres.

There are possibly 300,000,000 feet of the *savanna pine* in pocosins and around the edges of swamps and nearly as much *short-leaf pine* situated in the counties bordering the oak uplands. Most of this will be lumbered along with the loblolly pine.

The total amount of merchantable *long-leaf pine* now standing in the State is about 3,103,000,000 feet. The estimate of Mr. Kidder, of Wilmington, N. C., prepared for the United States Census Department, fixes the amount of timber, standing, on May 31, 1880, in the counties south of the Neuse river, at 5,229,000,000 feet. This, compared with the amount now standing in the same counties, shows a decrease of 2,000,000,000 feet in the amount of merchantable pine in thirteen and one-half years. At this rate of decrease in less than twenty years the long-leaf forests will be a thing of the past. The rate of decrease is, however, one of constant acceleration, since the yearly output of the mills is increasing and there is a much larger amount of abandoned orchard at the mercy of wind and fire.

At the end of twenty years there may remain scattered bodies of this pine remote from transportation facilities or too small to be profitably sawn, but there will be nothing more. The length of time the long-leaf pine will last can be stated with more certainty than in case of the loblolly pine, because in the case of the former there is no appreciable addition of merchantable timber from second growth woods.

The total amount of merchantable pine of all kinds (*loblolly, long-leaf, short-leaf* and *savanna*) in these Eastern North Carolina counties can be placed at about 8,200,000,000 feet, board measure.

The amount of standing swamp timber cannot be estimated with any degree of accuracy, since no average can be arrived at for the cut per acre, and only approximate figures can be gotten for the acreage. Cypress, for instance, will cut from 500 to 5,000 feet to the acre as a general thing, but numerous reports were made by trustworthy lumbermen of cuts running from 15,000 to 20,000 feet to the acre. There is a very wide range given for the amount of white cedar to the acre, but not so wide as that for cypress. The water oak and chestnut oak lands usually have a more uniform growth, and will cut from 1,500 to 3,000 feet to the acre. One of the chief difficulties connected with the handling of this oak, where such has been attempted, is that when green it has a greater specific gravity than water and cannot be floated out unless rafted with lighter woods. The same is true of the elm, hickory and much of the gum.

CHAPTER III.

THE WASTE LANDS OF EASTERN NORTH CAROLINA.

It is a very generally received opinion that the eastern part of North Carolina, especially that part covered with the long-leaf pine, is so densely wooded that for very many years at least there will be there not only an abundant supply of timber, but of a timber of the very finest quality. The long-leaf pine for nearly two hundred years has fully supplied all demands, not showing until very recently the least sign of failing. During the period between 1860 and 1870 the timber of the "pine barrens" was treated in a most reckless manner, and the fires which passed through them left traces which will last for many years to come, burning thousands of acres as clean as if they had been placed under cultivation. The timber which suffered most was that on the highest and driest land, where the ground was covered beneath the trees with a thick growth of wire-grass (*Aristida stricta* Mx.) and such broom grasses as grow on dry, sandy soil (*Andropogon tener* Kunt. and *A. Elliottii* Chap.).

The 3,100,000,000 feet of merchantable long-leaf pine still standing might seem to be sufficient to last for building and fence material in districts not readily accessible to large lumbermen for an indefinite time. But this is not so. The fact that since 1873 the output of turpentine in this State has fallen off over one-half, which of itself gives a very vivid idea of the number and extent of the turpentine orchards that have been abandoned, shows that it is now only a question of a few years before the turpentine yield will be reduced practically to nothing. This will mean that all the orchards have been abandoned, and it will be only a short time after their being abandoned before the destruction of the timber takes place, either by fire or by its being blown down, or by the two agencies combined.

The greater part of the dry upland soils of the pine belt are of two kinds: (1) the sandy loam soils of the level piney lands, and (2) the sandy soil, of nearly pure deep sand, characteristic of the *pine barrens* of the sand-hill regions. These barrens are dry and frequently form large tracts of rolling or even hilly land.

The first of these soils is not unproductive and is well adapted to agriculture; and as the original growth of long-leaf pine is removed from it the loblolly pine and a small growth of different kinds of oak, mostly the post, Spanish and black oaks, take its place. In the pine barrens, on the other hand, no oaks will flourish except two very small, worthless trees, the sand black-jack and the "barren" willow oak, and no pine except the long-leaf pine. Unless the soil has been previously cultivated the loblolly pine does not take posession of these lands, even when there are numerous trees of this species standing near by in wet places. From this it follows that when these high sandy lands are being stripped of their original growth of long-leaf pine, if its young growth is not allowed to develop, no tree of economic importance will naturally take its place. The sand black-jack oak in twenty years will have matured and begun to decay, while in that time a pine has only fairly begun its life, although its usefulness, even then, will be much greater than that of the more quickly maturing black-jack.

There are few uses to which the black-jack can be put. Its small size excludes it from being employed in construction; in contact with the soil it decays rapidly, and so is unfit for fence posts. It makes a very good fire-wood and is largely used for this purpose in Wilmington, Southport and other towns, and also in the country. Its bark is said to be valuable for tanning, but although the growth of this tree covers a very large area it is doubtful if the yield of bark per acre would be sufficient to make it of any commercial importance. The upland willow oak is even of less importance than the sand black-jack. While the presence of these trees is not pernicious, and is in fact much more beneficial to the land than would be a state of entire denudation of all forest growth, yet their growth is not near so valuable as that of the long-leaf pine, and the advantages arising from their presence are greatly inferior to those derived from a forest of the long-leaf pine of the same age. For this reason every means should be taken to enable the long-leaf pine to regain a firm hold on all high sandy land which has now on it no growth at all, or none of greater worth than the two oaks just referred to as growing on these lands.

SCARCITY OF TIMBER IN THE SAND-HILL REGIONS.

The exhaustion of the long-leaf pine forests is not a concern of the distant future alone,—something to be talked about and never to be realized. There are already localities, of limited area, to be sure, where there has never been a lumber mill, and with not one-tenth of the land under cultivation, where there is not now sufficient timber to properly fence the fields. The district around White Hall, Bladen county, is such a one, and this place is in the very centre of the long-leaf pine belt. Here good pine for fencing has become so scarce that a "stock law" or "no fence law" has been secured by which all live stock is to be confined to the Cape Fear river bottom, and that alone, fenced in across a bend of the river. There are other localities in Bladen, Sampson and Cumberland counties with about the same proportion of land under cultivation that find it hard each year to secure rails necessary for fence repairs, and obtaining them becomes annually more difficult as the forests from which the material is procured diminish in size. It is usually the case that some tree succeeds this pine as it is gradually cut off or otherwise destroyed, and this tree is usually the sand black-jack, and it forms over the land where the pine has once been a thicket of low, scrubby trees, which in less than twenty years will die and be replaced by a similar growth.

Scattered among these scrubby oaks are frequently stunted, knotty long-leaf pines, with a thin, sickly foliage of yellowish green, which are permitted to stand because they are regarded as useless. There are also large tracts of land on many acres of which there are no pines at all, and others where the black-jack even has not succeeded in getting a foothold, wire-grass and a few bushes being the extent of the vegetation.

THE LARGER TRACTS OF BARREN LAND.

Bladen county has its largest tract of this barren land in the northern part of the county, between the Cape Fear river on the south and Black river on the north-east, extending eastward as far as Lion swamp and west nearly as far as Parkersburg. It is about 18 miles long and from 4 to 10 miles broad, and has almost 70,000 acres of waste land in it. There are on it, however, a few bodies of pine in excellent condition, which either have not been boxed, or if boxed have been carefully protected; but for the most part it is covered with a scanty growth of sand black-jack, beneath which there is a great deal of densely tufted wire-grass, though in places there are only lichens and moss on the ground, or sometimes stretches of dazzling white sand. Here and there are small long-leaf pines, exhausted by the continued boxing.

In depressions where the soil is wet there are gallberry "bays" in which are a few savanna pines, but there is no loblolly pine except bordering the larger streams. These streams having loblolly pine along their banks are the Black and Cape Fear rivers, Colly swamp, Johns and Turnbull creeks. Colly swamp and Johns creek have in places a rich deep soil, formed of a fine silt largely mixed with organic matter, and could be easily drained. The drainage of Colly swamp for agricultural purposes is now being undertaken and it is probable that most of the swamp land will ultimately be drained, since it is much more fertile than the sand-barren uplands. This will mean, of course, the removal of the swamp timber. Although these streams have loblolly pine along their courses, its seed has never produced a young growth on any of the neighboring high sandy land; so that when the swamp timber is exhausted there will in reality be a dearth of building material throughout this region. The long-leaf pine timber from the tract was largely taken off to supply the mills at Wilmington, though much of it has been destroyed by fires. Even now some long-leaf pine timber, of an inferior quality, is obtained from here.

The surface of the land is gently rolling; the soil is nearly pure sand, with a small percentage of other mineral matter in it, and the subsoil, which is a light yellow sandy loam, lies too deep beneath it (from 8 to 15 feet below the surface) to be reached by the roots of trees. Generally there is no humus, the constant fires burning off the leaves and dead grass soon after they become dry. There are in Bladen county several smaller tracts of waste land, which lie south of the Cape Fear river.

In Sampson county there is, perhaps, no single tract of waste land which covers an area as large as 10,000 acres. But beginning in the south-western section of the county, near Autryville, and following the Black river down, there are several small areas of from 3,000 to 8,000 acres, all of which areas are in a bad condition. These have been burnt over and in many instances are still covered with charred stumps or encumbered with fallen trees. The surface sand here is not as deep as in Bladen, the loam usually lying about three feet below the surface; nor is it as continuous, being cut across by Big swamp, Big and Little Coharie, and by several other swamps and streams. The population here is thicker than on the southern side of the river, and there is more cleared land, but there is as yet no scarcity of good timber. As the trees are here worked for turpentine longer than elsewhere in the State there are less abandoned orchards and the forests are better protected. The combined area of all the waste tracts in this county amounts to about 25,000 acres.

Cumberland county has in its eastern part a continuation of the sand-hills of northern Bladen. The land in some places is more hilly, and the loam subsoil lies usually at such a depth below the surface (5 to 20 feet) that the roots of many trees do not reach it. The waste land lies mostly east of Fayetteville, all along Rock Fish creek, and south and east of Manchester. There are, however, many bodies of excellent timber in this latter section of the county. Along some of the creeks in the south-eastern part of the county the land is almost bare of all tree growth, while in other places, particularly in the north-eastern part, there is a heavy growth of sand black-jack, which has an average height of about 15 feet. There are at least 40,000 acres of such barren land in Cumberland county. Although not one-tenth of the soil is under cultivation several reports from the county state that in many places fencing material is becoming scarce.

Timber, other than the long-leaf pine, is not abundant in most parts of the county. The streams all have narrow channels and there is not much hardwood or loblolly pine along them. There are several white cedar "bays," but these can supply no building material. West of Fayetteville there is the same kind of soil that there is in the eastern part of the county, but there is much more timber standing. This part of the county is a succession of sand ridges and sand hills, which are covered with a fair growth of long-leaf pine. Nearly or quite all of this pine has been boxed, and although a considerable amount of lumbering has been done there remain large areas of valuable pine forests.

HARNETT COUNTY has in its southern parts a large area of waste land, which is in a worse condition than any other such tracts observed in the State. This is what is called the "Thomas Strange tract," which extends from the Lower Little river on the south to Little river on the north, and eastward 15 miles from Swann Station, on the C. F. & Y. V. R. R. This tract contains over 40,000 acres of waste land, two-thirds of which has but few merchantable pines on it and scarcely any sand black-jack. All of this except the part immediately adjacent to the railroad was reduced to its present condition by repeated forest fires, the thick wire-grass forming the fuel which carried the flames. The territory along the C. F. & Y. V. R. R. has been lumbered and there is still some lumbering operations going on along it where there are bodies of timber which have been protected from the fires.

The topography of the southern part of Harnett is similar to that of Cumberland. It is a typical "sand-hill" region, and its soil is sand with the loam lying very deep below the surface. The streams usually have narrow channels and very little hardwood or loblolly pine along them; but along Upper Little river and the Cape Fear there are in places wide and well-timbered "bottoms." The northern part of the county has a salmon-colored gravelly loam soil on which loblolly pine and white oaks are replacing the long-leaf pine. In the western part of the county and extending east from Jonesboro there is another tract which was burnt over several years ago and much of the timber on it destroyed. This latter area is not "waste land" now, but it soon will be. Harnett county, being intersected by the Cape Fear river and two of its largest tributaries which afford transportation facilities, furnishes yearly a considerable amount of timber (long-leaf pine) for the Wilmington mills.

MOORE COUNTY has 60,000 acres of waste land, all of which has been recently lumbered, though much of it has been burnt off subsequently. This land has a heavy growth of young sand black-jack on it, and in the localities more recently lumbered there remain a few scattered pines. It lies in the eastern and southern parts of the county, along the railroads. In places there are some post and spanish oaks with the sand black-jack oak, but there is almost no loblolly pine and no other material suitable for building purposes except the long-leaf pine. When lumbering has ceased there will probably be over twice the area of waste land there now is, since all the southern section of the county is high rolling pine barrens, with a deep sandy soil.

Richmond county has a soil in character similar to that of the southern part of Moore; but since lumbering has not been so extensively carried on in Richmond as in Moore there are in the former only about 40,000 acres of waste land, all of which have been lumbered except a few small tracts which have been burnt over. This waste land lies along the C. C. and R. & A. R. R's. It is covered with a thick growth of sand black-jack oak, and there are undersized pines scattered over a part of the area, many of them still being worked for turpentine. Except the long-leaf pine there is very little timber in the eastern part of the county suitable for building material.

Robeson county has very little waste land and very little deep sand except in the northern part of the county. In that section, adjacent to the Cape Fear river, there are possibly 10,000 acres with little tree growth except sand black-jack oak. In the middle and southern parts of the county the loblolly pine is taking the place of the long-leaf pine.

Brunswick county contains several thousand acres of waste and very thinly timbered lands along or near the sea-coast and the Cape Fear river. While these lands were never heavily timbered they are now rapidly getting into a deplorable state, which is a presage of the final destruction of the long-leaf pine.

Columbus county has about as much waste land as Brunswick. This land is in small tracts lying in the southern part of the county and the sand black-jack oak has taken possession of most of it. Good loblolly pine is, however, abundant through most sections of this county.

Wayne county has 20,000 or more acres of waste land covered only with sand black-jack oak and very scattering, exhausted long-leaf pines. This land lies in the central and southern parts of the county. Good timber is getting scarce in many places. Much of this sandy land in this and other counties has been highly fertilized and is cultivated in truck farms, vineyards and fruit orchards.

DUPLIN COUNTY contains several thousand acres, in the northern part, covered only with the sand black-jack oak, through which, occasionally, there occurs a few scattering long-leaf pines. Near the railroads a great deal of this sandy land, which has been highly fertilized, is used in this county for truck gardening.

ONSLOW AND NEW HANOVER COUNTIES have jointly about 25,000 acres of waste land, some of which is entirely denuded and some covered only with the sand black-jack oak. In many parts of New Hanover county, especially between Wilmington and Wrightsville, there is a very promising regrowth of long-leaf pine appearing, though the trees are very scattering and fires destroy a great many of the smaller ones every spring. The growth of timber in the eastern parts of New Hanover and Onslow counties, like that in the eastern part of Brunswick county, was probably never dense.

Besides the above tracts there are in *Johnston, Pender* and *Lenoir* counties a few smaller tracts which have been stripped of the long-leaf pine and on which no valuable regrowth has appeared; and there is immediately along the coasts of *Currituck, Dare* and *Carteret* counties a narrow strip of land which in many places is entirely bare, and has been described by the late Prof. W. C. Kerr as forming drifting sand dunes, which, along the coast of Dare county, "are moving under the impact of the trade winds constantly toward the south-west into the sound." What effect these moving dunes may have on the existing channels in the sounds or how they may modify or change the inlets between the sounds and the ocean are questions foreign to the present subject.

It is a well-known fact, however, that the breaking of the ocean, in 1763, through one of these untimbered sand banks formed the *New Inlet*, 16 miles below Wilmington, N. C., and seriously changed the channel at the mouth of the Cape Fear river, lessened the depth of its water and caused the expenditure of a large amount of money before the damage done could be rectified and the break securely filled. It could not be learnt whether this strip of sand dunes was ever timbered, though it is probable that at one time it was, since Smith's island and other parts of this same bank only a few miles distant are now heavily timbered.

THE ORIGIN OF THE WASTE LANDS.

From the preceding it appears that there is a large amount of waste land lying in the south-eastern part of this State. There are now over 400,000 acres of such land and the amount of it, from various causes, is constantly increasing. This land consists of high, rolling or hilly sand barrens, formerly covered with extensive forests of long-leaf pine. These forests yielded turpentine abundantly, but on account of the larger amount of sapwood and the coarser grain of the wood of trees growing on these poorer sandy lands the lumber, though of good quality, was of a grade inferior to that from trees grown on fertile soils. Now, however, owing to the grossest neglect, large portions of these forests have either been destroyed entirely or reduced to such a condition that there is neither mill nor turpentine timber on them, and no regrowth of the long-leaf pine has been allowed to take the place of the older trees as the latter were being gradually exterminated. The soils of the barrens on account of their sandiness and poor quality will produce very few kinds of trees which have any economic importance. No valuable broad-leaved trees (oaks, etc.) thrive on these lands, and among the conifers (pines, etc.) the long-leaf pine is the only one growing naturally on them.

The short-leaf pine, except where the loam subsoil lies near the surface, is rarely found, and it is only after the ground has been cultivated and enriched and the moister layers of earth have been brought to the surface that the loblolly pine will grow there. So it seems that the long-leaf pine is the only native tree of much value which flourishes on these barren, sandy lands. There are very few if any other forests in the eastern United States so peculiarly limited as to the variety of valuable tree growth as the long-leaf pine forests, particularly when it grows on the sand barrens; and there are no other forests which demand such care to obtain a regrowth of the original dominant species.

Many kinds of trees after having been lumbered or burnt out are succeeded by smaller and less valued species, but the original growth in time again takes possession of the land. This is the case with the spruce forests of Western North Carolina and the white cedar (juniper) in the eastern section of the State. However it may have been primarily in the long-leaf pine forests this is not the result under the present management of these pineries. After the removal of the pine the land quickly becomes waste land, and passes from a growth of sand black-jack to utter barrenness. Nowhere is there any general sign of either the long-leaf or any other pine again forming a prominent part of the growth on these sand-hills.

Unless there is some radical change in their management these lands may even cease to produce the few sand black-jack oaks which now flourish on them. There is even a possibility, and in fact it can be said a great likelihood, that this valuable tree, the long-leaf pine, will become extinct in North Carolina unless some steps are taken to secure its more general propagation. It has already become extinct over large tracts lying to the north of the Neuse river which were formerly occupied either exclusively by this pine or by mixed forests of it and hardwoods and the loblolly pine.

WHY LONG-LEAF PINE FORESTS ARE NOT SELF-PROPAGATING.

The causes which have operated to prevent the long-leaf pine from propagating itself are several, and all of them are important and act uniformly throughout this sandy area. A brief statement of some of the peculiarities of this tree may enable us to see more clearly why it needs more special protection than must necessarily be accorded other trees to enable the forests to reproduce themselves. The chief causes which have influenced and tended to retard the general regrowth of this tree at the present time arise from a highly specialized form of seed and plant structure and a decidedly unique manner of growth when compared with the other pines of this same region. These characteristic peculiarities lie chiefly in the young pine seedling, in the seed, and in the structure of the leaf buds.

THE SEEDING OF THE LONG-LEAF PINE.

Although the writer has not yet carried on systematic observations, on (1) the frequency of seeding of the long-leaf pine, (2) the relative abundance of its seed as compared with those of other pines, and (3) the relative fertility of boxed and unboxed trees of the same species, long enough to have obtained accurate results, yet the observations of different persons, thoroughly familiar, for many years, with the pines of the barrens, will, he thinks, for most of these cases, be found sufficiently accurate, their results being supplemented by his conclusions drawn from a personal investigation extending over several years. Although there were certain years in the primeval or virgin long-leaf pine forest, just as there are with all other trees, when no seed were borne, yet these years were rare and the yield of seed was usually abundant. William Byrd, writing in 1728, says* the mast of this tree (the long-leaf pine) is very much esteemed for fattening hogs, through all of Albemarle county (North-eastern North Carolina) on account of its greater abundance and the greater certainty of its occurrence (than that of the oaks). The forests of which he was speaking were largely virgin at that date. There are to be found frequent statements mentioning the same fact by other historians, of both an earlier and later date.

So far as could be ascertained the masts (as the seed of this pine are called) have not been as abundant for the past fifty years as they formerly were. There seems to have been only three large long-leaf pine masts since 1845. One of these occurred just about that time, the next one was in 1872 and there was one in 1892, which was not so large, however, as either of the preceding. There is a fairly abundant mast about every four or five years, and on intermediate years the production is small and localized. In North Carolina most of the trees which now bear seed are boxed and have been in this condition for from ten to fifty years. And the opinion prevails throughout the pine barrens that pine masts are less frequent and less abundant now than before the pines were so largely boxed and thinned out. The removal of a great portion of the trees may explain, in part or wholly, why masts are less abundant. It would naturally be inferred that there would be a large decrease in the productiveness of boxed trees, whose vitality, measured by the rate of accretion between them and unboxed trees, has been greatly impaired by the practiced manner of boxing. However, from a tabulated record of observations carried on during several years there as yet appears no marked difference between the productiveness of boxed and unboxed trees, similarly situated.

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*History of the Dividing Line between Virginia and North Carolina, p. 29.

There are several important differences between the reproductive capacities of the loblolly and long-leaf pines, all of them to the advantage of the former. The fertility of the long-leaf pine is much less than that of the loblolly pine, its most frequent associate. The loblolly pine bears cones at an earlier age, and usually produces more seed, both perfect and imperfect ones, and the great variety of soil on which the loblolly pines grow causes a slight difference in the time of flowering of different trees, making this pine less liable to have the entire prospect of a seed yield destroyed by frosts, or by heavy rains during pollination. While this may possibly explain why the loblolly pine has come up as a regrowth over so much of the moister loam land it has affected the growth of the pine barrens very little.

The seed of the long-leaf pine are very large, one-third to one-half an inch long, independent of the wing, while no other pine of this region has seed over one-fourth an inch long. But there is a much smaller proportion of abortive and otherwise-imperfect seed in a long-leaf pine cone than in the cone of the loblolly pine. This would be decidedly to the advantage of the long-leaf pine in seeding old fields, etc., were its seed not too heavy to be carried far by the wind. They usually fall within fifty feet of the parent tree, while the light-winged seed of the loblolly have been known to scatter thickly over fields from trees more than a quarter of a mile distant; and single seed are reported to have been blown several miles. And furthermore, as described more fully beyond, the seed of the long-leaf pine are much more extensively destroyed by hogs, fowls, squirrels, rats, etc.

Another reason for the exclusively loblolly growth in fields may be that even when the seed of the two pines fall on the same land the loblolly pine by its rapid growth during the first few years overshadows and effectually crowds out the more slowly growing long-leaf pine, and the latter during this early slow growth are easily destroyed by fires and by live stock. The two are, however, rarely seen associated together in second growth woods. The seed ripening in October fall to the ground rapidly and if there is a warm moist season sprout immediately. In the event of a long warm rain just after the seed are matured they will frequently sprout in the cones and the entire yield will be thus destroyed.

DESTRUCTION OF THE YOUNG PLANTS.

The young long-leaf pine seems to be especially adapted by the form of its root system for growing on a sandy soil. By the end of its first year's growth its root system, which has grown rapidly, consists of a large tap-root which extends 6 to 10 inches deep in the sand, and from the bottom of it branches out the smaller roots which draw nourishment from the soil. It is this deep-seated root system sent thus early far down into the soil which enables this pine to grow on the sand barrens, and it is doubtless because the roots of the loblolly are small and divide for the first year or two into a great many small divisions, lying near the surface, that it does not get sufficient moisture and nourishment from the dry surface sand to enable it to thrive on the sand barrens before this land has been cultivated. This long tap-root of the long-leaf pine frequently goes through the sand into the loam soil and secures for the tree a firm anchorage against storms and enables it to draw its nourishment from a more fertile soil.

The stem parts of the long-leaf pine are as peculiarly adapted for growing on a sand soil as the root system is. Instead of the stem's branching or growing the first year it only puts out a great number of very long thick leaves, exceedingly close to the ground. These leaves soon spread out and help to shade the ground close to the plant and keep it moist. At the end of the first season's growth the single (terminal) bud is not over an inch and a half above the earth and the bud itself is nearly an inch long, so that it can be said that the stem of the seedling does not grow any in height during the first year, all the energy of the plant being diverted to increasing the root and producing the great tuft of long deep green leaves which spread out immediately below the bud and make the plant resemble more a tuft of some marvelous kind of grass than a young tree. Some of the lowest leaves usually die during the first year; most of them remain on, however, for two seasons.

During the second and third years the growth of the stem in height is slight, though it increases in thickness, but after that, at least in a forest, its growth is wonderful. Frequently in a thick wood where a young tree has been allowed to grow, in 8 or 9 years after height-growth has begun, it will have reached a height of 18 or 20 feet and a diameter of no more than 3 or 4 inches, and will have grown each year from only one bud, the terminal bud, at the end of the woody axis, there being no branches, and no sign of any having been formed. For leaves there will be only a single, broom-like bunch terminating the slender stem. The rapidity with which this stem is raised and the fewness of its branches until the natural height of the tree is reached makes one of the fine qualities of the timber. It gives long stocks which have no knots in them, even small ones, to produce any ununiformity of quality, or to make weak places on the interior of an apparently perfect piece of timber.

This feature which is the cause of so fine a quality of wood is a great drawback to the development of the young trees. This single terminal bud is a very large and complicated structure, and when once destroyed in any way no other bud is usually formed by which the growth of the young seedling can be continued. It is true of most conifers (*i. e.*, pines, firs, cypress and cedars) that they do not readily form buds and that they rarely sprout from the stump and are very difficult to reproduce from cuttings, etc., but with the long-leaf pine such buds are formed and sprouts developed even more rarely than with most other conifers.

THE ENEMIES OF THE LONG-LEAF PINE.

The long-leaf pine has a severer struggle for existence than any other of our forest trees for the reason that in all stages of its reproduction and growth it is more severely and continuously attacked by a greater variety of enemies than any other. Besides the natural drawbacks to its development from the peculiar manner of forming several of its parts, and the fact that these parts when destroyed are not replaced, its large and sweet seed are eaten in large quantities by *fowl* of various kinds, *rats*, *squirrels*, and by *swine*, which prefer them to all other kinds of mast and, when there is enough long-leaf pine mast, become very fat on it.

As far as has been observed, young long-leaf pines are attacked by no injurious beetles or bark-borers or by any fungi sufficiently to injure them. The mature pines, however, have in past years several times been attacked by bark beetles in such numbers as to destroy the pine over large areas. A few trees which have been killed from their attacks can be seen at any time around the edges of districts where lumbering is in progress, or about districts which have been recently lumbered.

DESTRUCTIVE WORK BY HOGS AND FIRES.

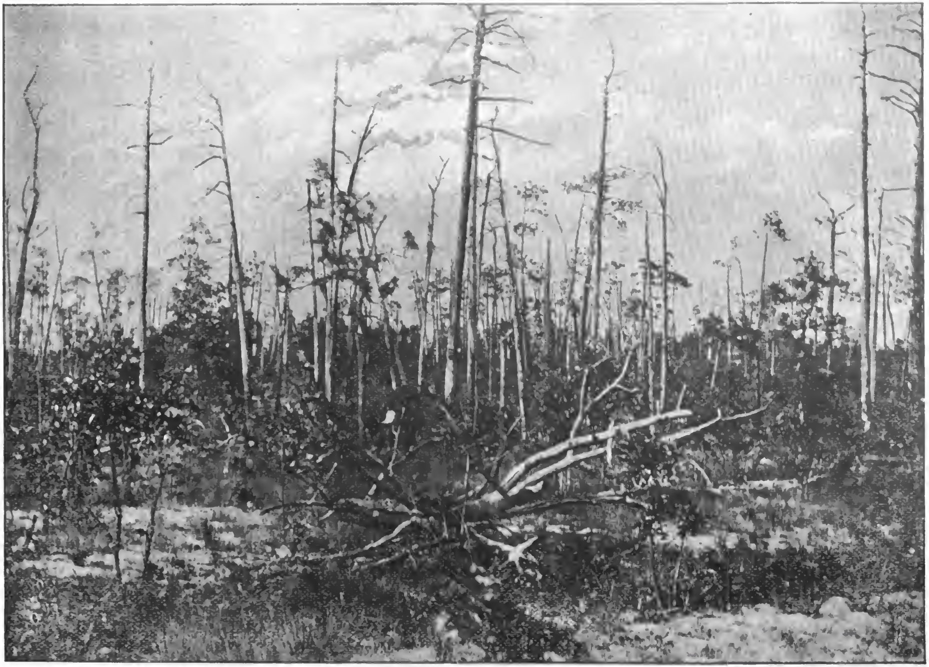
If the destruction by swine ceased with eating mast there would still be sufficient seed left to reproduce some parts of the forests, as the mature trees are gradually thinned out, for one-year-old seedlings are common twelve months after a heavy mast. No sooner, however, has the young pine gotten a foot high and its root an inch in diameter than the hog attacks it, this time eating the roots, which, until two inches in diameter, are very tender, juicy, pleasantly flavored and free of resinous matter. In the loose sandy soil the piney woods hog, or "rooter," finds little difficulty in following and devouring these tender roots to their smallest ends. Many small trees are destroyed in this way. And cattle, furthermore, are said to bite off frequently the tops of the small plants, and with them the terminal buds, in the early spring. This is doubtless done while grazing, more accidentally than otherwise.

Fires often destroy all the young pines that escape the hogs. They kill the small pines by burning the highly inflammable bracts around the bud and so stop its growth, or in high grass frequently burn all the leaves. Larger trees, even until they are 3 or 4 inches through, are easily killed in spring, when the sap is rising and the outer layer of wood is growing rapidly, by a hot fire which will burn the thin exfoliated layers of bark all over the trunk. The loblolly pine is less injured by fire because its bark is thicker and so offers more protection to the growing wood; the bark, too, lying closer to the wood in firmly appressed layers, does not so easily take fire. (See, also, the discussion on page 61).

The chief agencies, then, which prevent a regrowth of the long-leaf pine on the high sandy lands are the hogs and the fires; and the attacks of the hogs are directed against parts which seem to have been developed to meet requirements of a plant growing on a dry, barren soil of loose sand. These peculiarly developed parts are the seed, large for a pine, which contain abundant nutriment for the young plant to enable the root to push itself rapidly into the sand; and the long, succulent root which grows for a considerable distance straight down without branching. Since the first settlement of these sandy lands the "ranging" of swine has been allowed in the barrens, and while there were enough pines standing and frequent masts, they fed a large number of hogs.

The practice of firing the barrens has been adopted in many cases with a view to improving the pasturage; while in many other cases, after the trees were boxed, the leaves and trash pulled away from around them, the forests were burned over to prevent in a dry season a chance conflagration getting from under control and burning the faces of the turpentine boxes and the timber. That this policy of burning the barrens is a very bad one and calculated to do far greater damage than that immediately apparent has perhaps been made evident. The accompanying illustration (Plate I) shows one of these long-leaf pine forests, near Southern Pines, where a recent fire destroyed all of the young growth, the turpentine boxes and most of the timber trees.

That sooner or later the present management, or lack of management, which has characterized all dealings with the barrens for the past 150 years must be changed if the long-leaf pine forests are to be made self-propagating, no one who has ever seen their condition or fully realizes what it is can possibly doubt. The logical result of these burnings in the past has been the destruction of millions of feet of standing pine and the prevention of the growth of young trees, which, had they started even fifty years ago would



LONG-LEAF PINE FOREST A FEW MONTHS AFTER THE FIRE; MOORE COUNTY now be large enough for small mill timber and for turpentine; while the burnings of the present and future, if not soon discontinued, will mean the final extinction of the long-leaf pine in this State.

THE ULTIMATE UTILITY OF THESE WASTE LANDS.

It has been practically demonstrated, in the vicinity of Southern Pines and elsewhere, that, after having been richly fertilized, considerable portions of these sandy pine-barren lands, containing a small portion of loam and organic matter mixed with the sand, are adapted, by their southern situation and light, friable soil, to a high state of productiveness in fruits and vegetables; and these branches of agriculture are rapidly increasing in North Carolina. They appear to be more especially suited for vinticulture and gardening. It is probable, however, that large portions of these waste lands will not be brought into cultivation during the next fifty years, nor at any time, owing to the extreme poverty of the soil. What then is to be done with this 400,000 acres, once covered with long-leaf pine, but now of little more value than a similar area of a genuine desert? If the present lack of policy in regard to their management is continued, it is only a matter of a few years before the long-leaf pine which is now standing on the sand-hills will also have been destroyed without giving profitable returns to its owners or leaving behind it a young growth of pine to take its place. It becomes manifest at once that if the scattering trees, which might serve as seed trees, are entirely removed from this waste land, it will not only be a very difficult but a very costly matter to secure a regrowth of long-leaf pine or any other valuable building tree, either pine or hardwood.

No matter what is the ultimate use to which the land may be put there must necessarily be, on a considerable part of it, trees which grow large enough to furnish timber and fuel more abundantly than the black-jack oak can do. A pine alone can supply such wants when there is only an impoverished soil to grow on, and the long-leaf pine can do this better than any other pine.

No community, least of all one devoted to agriculture, no matter whether it raises cotton, garden truck or fruit, can be independent while at the same time it is dependent on some other section for either fuel or building material. This, however, is what some sections of eastern North Carolina are fast coming to, and the fact is being recognized by not a few of their most thoughtful residents.

That the existence of a highly developed agriculture is sometimes entirely dependent on a forest is shown by the condition of the lands between Bordeaux and the coast of France along the bay of Biscay. This district is the seat of the manufacture of the Bordelais wines, clarets and other light wines, and some of the finest wines are made in vineyards east of the Médoc from vines grown on a highly sandy soil. A great part of this land is covered with forests of pines, which were set out, at great expense, to prevent the shifting of these sandy soils. Before the planting of the forests these lands were sand dunes, or heather lands which formed dunes of moving sand as rapidly as the low, scattered heath growth was removed.

In view of the facts stated in the preceding pages we are driven to the conclusion that the most practicable plan of treatment of these waste lands, with a view of making them again productive of wealth to their owners, is that of protecting these areas against the attacks of hogs and forest fires and thus permitting them to be again covered with a new growth of long-leaf pine.

COST OF SECURING A NEW FOREST GROWTH.

The cost of securing a regrowth of long-leaf pine on most of this waste land would now be very little in addition to what the land-owners must necessarily pay to retain their land which has ceased to be productive or give any returns. Interest on the capital invested in the land probably has to be paid and taxes must be paid yearly. The additional cost would be solely that arising from protecting the land from fire and from excluding cattle and swine for a certain number of years after a mast.

The opposition such a measure would produce would be considerable, especially among a class of indigent citizens who, owning little or no land themselves, have always been accustomed to give their cattle free range over the lands of others, to fire the dead grass for bettering the pasturage, and even to cut timber for home use on these lands *ad libitum*. It is the opposition of these people, who constitute so large a part of the voters, that has prevented in several of these eastern counties the adoption of a general law for confining cattle and stock. As timber for fencing material and other purposes becomes scarcer, the more intelligent citizens are coming to see clearly enough the imperative need of such a change, both in our laws and in public opinion, as will suffice to protect the young forest growth from fires and stock, and thus to give the valuable forest trees an opportunity to propagate themselves.

NECESSARY PROTECTION OF YOUNG PINES AGAINST FIRES AND HOGS.

Without a thorough cessation of fires and an equally thorough exclusion of stock, at least until the trees are thickly started and well grown, say until 10 feet high, any effort to produce a uniform growth would be futile. Once that a new growth has secured a firm foothold and has formed a dense covering, the very thickness of it, by its exclusion of most low growth and grass, will be preventive of fires, since the thin covering of pine straw and humus will not carry fire except in very dry seasons or before a heavy wind. The exclusion of swine is a measure which must be absolutely enforced until the trees have reached a diameter of 3 or 4 inches. (See, also, page 57).

The following statements will show what an important part fires play in the destruction of pine seedlings:

In the fall of 1892 there was a very full long-leaf pine mast, and in the following spring seedlings could be seen by thousands. In moderately dense long-leaf pine forests in Montgomery county, where there was about one-half as many of those pines standing as when it was in a virgin state, these pines being mixed with a few post and black-jack oaks and the rest of the land open, there were from 15 seedlings to the square yard in the open to 35 seedlings on an equal area beneath some of the trees. A space which was staked off and noted was examined again in the fall after a fire had passed over it and then it did not average one seedling to the square yard. The soil here was a salmon-colored loam and the grass largely broom-straw (*Andropogon Virginicus*).

Another tract, which was on the sand-hills of the western section of Cumberland county, was examined shortly after it had been lumbered. This was not seen in the spring, but when visited in the fall showed by the great number and position of the cones that seed must have fallen abundantly over most of the ground which had since been burnt over. It was hard to find, however, a seedling which had escaped the flames.

Another place examined was in Bladen county, on a sandy loam soil. There were in the spring of 1893 numerous seedling pines there. A later examination in the fall showed a large number still growing, but no fire had passed over them and the roots were not yet large enough for the hogs to root up. A small portion of this last tract has been fenced off and the progress of the seedlings in the enclosure, and those outside, will be compared and the requirements and peculiarities of the young plants studied as they develop.

If it had been possible, immediately after the falling of this mast of 1892, to put the long-leaf pine lands, or at least those parts which are most sandy, and have only a thin cover of pines, or the large areas recently lumbered, under some management which would have given protection to the seed and later to the young pines, in ten years with continued protection there would have been over the larger part of this area a thicket of pines large enough to have been self-protecting in a great measure, and in a fair way to become trees suitable for lumber and for yielding supplies of turpentine.

At the date of this writing it is a safe statement to make that there have been already destroyed over nine-tenths of the pines which sprung up so abundantly less than two years ago. The time which will elapse before another large mast is of course uncertain. Smaller masts should occur, however, in three or four years. Last year (1893) there was none. An examination of the pines shows that there will be very little this fall. The freeze in April of this year (1894) destroyed the pollen of the trees along the western part of the pine belt, but as they have not been examined further east it is uncertain whether it was destroyed there also.

There will consequently be little pine mast in 1895, at least in the western parts of the long-leaf pine belt, as it requires two seasons for growth and maturity after pollination has taken place.

FOREST MANAGEMENT IN THE WASTE-LAND REGIONS.

Just here, in connection with the discussion as to what policy should be adopted in regard to the treatment of the pine barrens, a brief statement of what forestry is and what it necessarily is not, will not be out of place. The two conceptions as to what forestry is are in part equally erroneous. One of these is that forest management consists in protecting trees with no definite end in view beyond that of protection. The other conception contains a half truth. It is that forest management consists in the production of trees and the systematic management of timbered lands, but that the State or government's ownership of such timbered lands is essential for putting this into practice. This latter view of the matter is fairly correct except that ownership or management by the State or government is by no means an essential feature. In a country such as ours timber lands must be managed by their owners or not at all.

From the point of view of a money-yielding investment, and this is the chief view that need be considered in dealing with most of the lands of eastern North Carolina, the following might stand for a definition of forestry: Forestry consists in the systematic care of forests so that the land will always yield valuable forest trees and so that production of timber may be carried to its highest possible limits. This growth of course is to be utilized, *but in such a manner that a young growth of equal value to the one removed may take its place.* Such management is not only not inconsistent with private ownership of land, but if properly carried out by private parties can be made more efficacious, at least as far as financial results are concerned, than when carried on by a government or State.

It is true that in some European countries much of the forest is owned by the various governments, municipalities, etc., but much of this land was owned by the respective governments for many years before any forest management was practiced. Their ownership by the governments was not at all necessary for the practice of forestry in these countries, and there is more forest land under systematic management in Europe owned by private parties than by the governments.

In some of the private forests, as those of the Tyrol, cuttings are restricted and are superintended by trained government foresters, because from the situation of the lands in hilly or mountainous districts the sudden removal of all timber from over a large area might cause the land to wash, so that reforestation could only be accomplished under serious difficulties. The clearing of large areas and their remaining in a state of denudation causes in hilly countries, where the soil washes easily, great floods in the rivers which are filled with *detritus* washed down from the hills. Such floods endanger the life and property along the streams, while the deposit of the soil washed down seriously affects arable lands and the channels of the streams. The control of such lands as these is not undertaken by the governments with a view of influencing in any way the owners' profit, but as a measure to protect other citizens whose interests might be much affected by any carelessness or greed of a timber owner.

In Germany, which country probably leads the world in the thoroughness of its forest management, there are about 43,000 square miles of forest.* The government owns about 13,300 square miles of it, various local organizations, towns and small principalities own 6,700 square miles, while the rest, about 21,700 square miles, belongs to individuals, and its management is entirely free from all governmental interference, except so far as the cutting of one person's timber will damage lands or property belonging to another, in which case an injunction to prevent cutting can be obtained from the courts.

THE NECESSITY FOR FORESTS IN THE FUTURE.

The question is asked, Will there be any use, fifty years from now, for a forest grown on this waste land when so large a part of the State and country will be timbered by a second growth of pines and hardwoods which have naturally sprung up? Moreover, it may be thought that in that length of time a large part of the original forest growth will still remain uncut.

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*Paul Pary's Yahrbuch, 1890. Landwirtschaftliche Statistik, 1889.

An examination of the facts in the case will yield an answer. Ten years ago it was thought that the supply of white pine was inexhaustible in Michigan, which State then had far the largest bodies of pine, and in fact nearly all the merchantable white pine in the United States except that in Wisconsin, Minnesota and some in West Virginia. Bulletin No. 5 of the Eleventh U. S. Census showed that in 1890 Michigan had an output of white pine of about 10,000,000,000 feet, board measure (including shingles), and that there was supposed to be only enough timber standing to last the mills for five years longer. Many persons even then ridiculed the idea of the exhaustion of the white pine. A few months ago the *Northwestern Lumberman*, which had most loudly proclaimed that the white pine was inexhaustible, announced that this season there would be in one district a shortage amounting to many million feet, and that the total shortage in Michigan alone would probably amount to over a billion feet, board measure. Other soft woods, yellow poplar, etc., will probably be sawn to take its place for several years, and will come from Kentucky, Tennessee, North Carolina and other regions in the Appalachian mountains.

In ten years from now the forests of Michigan will have been a thing of the past, so that within fifty years after lumbering began on a commercial scale the white pine and probably the best hardwoods will have been cut out. These forests of Michigan cut from two to three times as much mixed hardwood and pine to the acre as the pine lands of eastern North Carolina will now yield, after having been picked over for two hundred years.

The forests of Washington are as yet in a nearly virgin condition and are probably the finest in the world. They will cut three times as much to the acre as the pine lands of eastern North Carolina, and although the amount of standing timber was estimated on January 1, 1894, to be near 400,000,000,000 feet, board measure, yet such is the enormous destruction of timber by fire and the rapid increase in the milling industry, which now cuts only 1,000,000,000 feet a year in that State, that those forests will probably not last longer than fifty years.

The forests of all the Northern States have been cut over and the most valuable timber removed. Maine, Vermont, western Pennsylvania and West Virginia still manufacture, however, large quantities of hardwoods, but the supply of them is so rapidly being reduced that in a few years the annual output will be reduced to the growth in the forests during a year.

The condition of the timbered lands is about the same in all the Southern States. The pine in the lower districts has in places been entirely removed, but in other places there is still much left, while the hardwood on the uplands has for a century been called upon to supply local needs and in most places has had the finest timber culled, except toward the mountains of the south-eastern States where there are magnificent virgin forests of hardwoods. These forests of the South are the ones to which the lumbermen of the North are looking as the supply of timber near the seats of consumption becomes exhausted, and once that the tide of millmen turns this way the depletion of the forests of this State and those farther south will be a matter of only a few years.

Bulletin No. 5 of the Eleventh U. S. Census gives the amount of yellow pine and cypress land owned in nine Southern States by establishments located only in Michigan and Wisconsin to be 1,407,358 acres, estimated to have standing on them a total product of eleven billion feet, board measure, of merchantable timber, valued at $8,723,000. The timber on this land is cypress and hard pines—*i. e.*, long-leaf, loblolly, and short-leaf pines, and this large amount invested shows that Michigan millmen, already foreseeing the exhaustion of the northern forests, are investing in those timbers which are suitable to take the place of the white pine. Even at the present rate of removal, and allowing that there is no decrease in the business from the free entrance into the United States of Canadian lumber, the standing pine in the eastern part of North Carolina cannot last twenty years, and may not last more than fifteen years, unless a wise policy obtains. The indications are, however, that there will be in the next five years a much greater expansion of the milling industry in eastern North Carolina than has taken place during the past five years and a proportionally greater increase in the annual output of lumber, and decrease in the available supply of standing timber.

WILL A REGROWTH OF PINES ON THESE WASTE LANDS PAY?

This question has been asked; and it is the first point to be considered in connection with any attempt to restock these waste lands with long-leaf pine. And in answering this question we may ask another: Will it pay to let these lands lie idle and unproductive? The cost of securing a growth of pines on these lands will be the cost of keeping off the hogs and fires, and this will be but little if any more than what proprietors have to pay at present for the privilege of holding these unproductive tracts. If it pays to own these lands unoccupied and unproductive, it will pay much better to own them if they are restocked, at a slight cost, with long-leaf pines.

One of the chief considerations upon which the final value of a regrowth of long-leaf pine depends is the securing, in as short a time as possible, a thick, homogeneous growth of young trees, and the entire prevention of all fires among the pines. Nowhere else is the truth of the strength of unity more exemplified than in a forest growth, especially in a young and growing forest, on an arid and impoverished soil, where one of the necessities is retaining the moisture in the earth and preserving the humus formed by the decay of leaves. This moisture will serve to supply the trees with water essential for their development and tend to check or even prevent fires. The damage fires do to a forest growth, even after the growth is well started, is considerable and has much influence on the character of the timber. By killing a part of the timber they make the growth open and the stocks short-bodied and filled with limbs and resulting knots. The thicker the growth the taller and straighter will the stocks be, and so much greater and more valuable will be the *final* yield of timber.

RATE OF GROWTH OF LONG-LEAF PINES.

After a large number of measurements of young growth trees, which have sprung up in enclosures, or where protected, it has been ascertained that it will require from thirty-five to fifty years for such a growth to reach sufficient size to furnish saw logs 20 feet long and from 14 to 20 inches in diameter. The usefulness of these trees will have begun, however, in less than half of that time, since their increase in size is much more rapid during the earlier years of growth than during the later years. After twenty-five years they will be large enough to hold a turpentine box. About this age, too, they begin to bear mast, and as the foliage becomes more open the more tender grasses of the barrens appear and afford pasturage. Besides this there is a great quantity of litter which yearly accumulates under the trees and can be used, as such litter now is, when it can be gotten, as a mulch for agricultural lands. Moreover, the lands themselves will have gained a permanent improvement from the mould which will have accumulated on the ground during the time that the trees were growing.

FUTURE VALUE OF TURPENTINE ORCHARDS.

What may be the value of turpentine orchards twenty years hence is of course a speculative question. With the great variety of uses to which both rosin and turpentine are put it is hardly likely that in that time any cheaper substitute will be found for them in all their uses.* The area of long-leaf pine which will be under orchard at that date is also largely a matter of conjecture. The observations of the writer and of several specialists who have examined all or parts of the territory covered by the long-leaf pine, would lead to the conclusion that, without some radical change in the manner of boxing, and the reservation by timber owners of large tracts of pine for turpentine culture only, the orchards of the United States, with the possible exception of those of Texas, will have seen their best days in less than twenty years.

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*USES OF RESINOUS PRODUCTS.—In a report upon the maritime pines made in 1878 by M. Desnoyers at the Universal Exposition of Paris the following uses are given for the different resinous products of that tree:

Spirits of turpentine is used in the manufacture of oil colors, varnishes and paints, in the preparation of rubber, is employed in medicine and veterinary arts, and for cleaning and illuminating and making water-proof putties and cements.

Rosin is used in sizing paper, in soap-making, in the manufacture of sealing-wax, for soldering lead and in tinning, and from it is obtained by destructive distillation rosin oil which is used in making lubricants, printing and lithographic inks, paints, etc., and painting beer-kegs Crude turpentine scrape and pitch are also used in many of these manufactures.

The Report of the U. S. Division of Forestry for 1891 describes the pine lands of eastern Texas and western Louisiana as follows:* In the center of the region above the Red river, pine ridges alternate with tracts of oak and hickory. Toward the Red river the forests covering the undulating pine lands remain practically unbroken to the Sabine river. On the east side of the Red river the area is estimated at 1,625,000 acres, extending northward an average distance of fifty-five miles, cutting from 4,000 to 6,000 feet to the acre, with no change in character to Trinity river in Texas. In that State the forests of long-leaf pine cover about 5,000 square miles, merging toward the north into the region of short-leaf, toward the south into vast forests of loblolly pine. The fact that but little tapping for turpentine has been practiced in this region may be of importance from a market point of view.

Forests suitable for the manufacture of turpentine, being subject to a triple destruction, will probably give out some time before those suitable for lumber will. Turpentine orchards of long-leaf pine are destroyed by being lumbered, by natural exhaustion from continued tapping and by fires; and their trunks being weakened by boxes the trees are more liable to blow over by the winds. They are renewed only to an inconsiderable extent by regrowth. The rate of destruction by each of these agencies has been yearly increasing, and has not yet reached its maximum limit.

FUTURE VALUE OF LONG-LEAF PINE FORESTS.

The future value of a forest of long-leaf pine as a source of lumber is based on these facts. Long-leaf pine wood, even after it has been tapped for turpentine, which has no effect on any of the heart wood except to a slight extent those parts immediately in contact with the faces of the boxes, is much stronger than any other of our pines; and it is especially durable in contact with the soil or when exposed to alternating conditions of being wet or dry. As these qualities of the timber become recognized they will much increase the value and use of the wood for purposes where such qualities are requisite. The rapid thinning of the woodlands of the eastern United States will cause an increase each year in the value of all timber near centers of consumption; and there is a constant increase in the value of stumpage as the utilization of the forests proceeds. When once the mass of standing woody material, the uninterrupted accumulations of centuries, is destroyed, the entire country will each year be dependent for wood on what may be called the annual increase in the forests.

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*Annual Report Secretary of Agriculture, 1891, p. 216.

The lands of the greater part of the northeastern States are already in this condition, and those of the southern States, with the exception of the hardwood forests of the Appalachian mountains, are fast being reduced to a similar condition. This second growth forest is producing very largely nonvaluable woods, having been produced by the seed of inferior species left in lumbering as worthless, and only such of these survive as can naturally withstand the repeated burnings to which the woodlands are subjected. Moreover, most of this second growth is very open and thin, caused by fires and other agencies, and the trees from the same causes are often defective. A large part of the land which should be timber land is unproductive waste land, with absolutely no arborescent growth, and the continued violation of all natural laws concerning plant-life prevents the development of such a growth. The demand for wood is yearly increasing and each year the power of the woodlands to supply it is diminishing.

An abundant supply of wood and timber must be an important factor in the future development of eastern, and particularly south-eastern North Carolina, whether that development be an agricultural or manufacturing advancement; but unless there is a more strict observance of the fundamental laws of all plant-life, particularly in respect to the long-leaf pine on the high sandy land, preventing the destruction of the seed and young pines, this section will be in great want of timber at the time when it will need its timber most.

AREA OF WASTE LAND INCREASING.

In conclusion, it can be said that there are now 400,000 acres of waste sandy land in Eastern North Carolina, and that this area is constantly increasing. This land is covered only with a low, scrubby growth of sand black-jack oaks and in places has mixed with these oaks scattered long-leaf pines, unfit for lumber and exhausted of turpentine by the continued tapping. Malpractice, especially the custom of firing the barrens and allowing stock full range on them, has never given the long-leaf pine an opportunity to reproduce itself except over very limited areas, and where protected. From this cause this pine, which will always have the highest value, both for its timber and the abundant resin which it contains, is in danger of becoming extinct in North Carolina, and indeed in all the States where it now grows, at least as far as its commercial importance is concerned.

IMPORTANCE OF EARLY ACTION.

If the long-leaf pine which is still standing is allowed to seed these lands, and the seed and young pines protected from destruction, a regrowth can be obtained with comparative ease, but if the long-leaf pines now standing are once destroyed, the securing on these waste lands of a growth of trees which will be of economic importance will be both a difficult and costly undertaking, since this pine is the only tree of value in the arts which naturally grows on these barren lands. It will cost very little more to secure a regrowth than it does to retain the lands in their present impoverished and unproductive state, since taxes and frequently the interest on the original investment must be paid.

The adoption of some general law for these districts, requiring stock, especially swine, to be confined, would be of great help in securing a regrowth, but it would be imperative, at the same time, to prevent any fire from passing through the barrens, since one fire can kill in a few hours a growth of pines several years old. The final value of the growth would depend, too, on fires being kept out even when most of the trees were large enough to be uninjured by burning. By the time such a growth reached maturity or became large enough to furnish timber, all the original forests will have been cut over and the usually thin and scattering regrowth will be called upon to furnish not only most of the fuel, but all lumber and timber required in building and manufacturing.

So great is the annihilation of the primitive forests and so rapidly does the demand for lumber increase from year to year that it is doubtful if the entire forests of the Southern States can last longer than two or three decades. The same is true of the pine forests which can be used for turpentine production. The ruin of these forests will cause a marked rise in the value of all forest products, so that a certain and a higher-priced market can be assured for all future forest material.

CHAPTER III.

THE NAVAL STORE INDUSTRY IN NORTH CAROLINA.

HISTORICAL SKETCH.

IN COLONIAL TIMES.—As early as 1700 the production of naval stores was an industry of some importance in the Colony of Carolina. At the same time the industry was carried on in the adjacent parts of Virginia. In Virginia the products were largely derived from the loblolly pine, while in North Carolina they came chiefly from the long-leaf pine. The products exported from the colony at that date were tar and pitch and some crude turpentine; but the quantity of the latter shipped was small. Tar kilns were made then as now and the process of burning was the same. Indeed, the process is very much the same as that described by Theophrastus as being used by the ancient Greeks.

The *tar* manufactured in the Southern States was more commonly converted into *pitch* before being shipped, by the addition of some crude turpentine and the mixture then being boiled down to the right consistency. From north-eastern North Carolina it was shipped by way of Norfolk, Va., to England, the laws of England at that date forbidding colonial products from being shipped to other than English ports. Until about 1800 the making of tar was not as largely confined to North Carolina as it is at present, nor even to the Southern States. Besides being burnt in Virginia from the loblolly and short-leaf pines, some was made in New York and other Northern States from the pitch pine (*Pinus rigida*), but more for home use than for export. Georgia and South Carolina also produced considerable amounts in colonial days. The method of cutting the boxes for collecting the crude turpentine was then the same as now. The names of some of the parts connected with the process have slightly changed in the meantime. *Cornering* was then called *notching* and the *virgin dip* was called *pure dippings*. These names continued in general use until the early part of the present century.

Both the tar and the crude turpentine produced in the northeastern part of this State were marketed, in the early days, usually in exchange for goods, at Nansemond or Norfolk, Va., and there found ready sale. Before the beginning of the present century both commodities had practically ceased to be produced around Albemarle sound. The seat of the industry slowly moved westward from thence up the Roanoke and Tar rivers and southward, as the settlements extended, to Washington and Newbern, both points shipping large quantities of naval stores to New York and Philadelphia, where it was reshipped to England, and there the crude turpentine was distilled. The largest special use for the crude turpentine in the United States then was for mixing with fats, etc., in making yellow soap.

Later Developments.—Before 1800 Wilmington became one of the largest shipping points for both crude turpentine and tar. In 1804 the exportation of crude turpentine from Wilmington amounted to 77,000 barrels, and the total amount of naval stores shipped exceeded that from all other ports of the United States. The crude turpentine was brought down the rivers on rafts and small boats from as high as Edgecombe county to Washington, from Wayne county to Newbern, and from all the northern tributaries of the Cape Fear river to Wilmington, and was distilled in crude iron stills partly at the shipping points, partly in Philadelphia and New York, and much also went to England to be there distilled. The spirits of turpentine usually found quick sales and good prices except when overproduction took place, and was preferred in France even to the Bordeaux turpentine, which was made in the department of the Landes in Gascony, being less odorous and more uniform in quality than that. The rosin manufactured was worth very little, getting down as low as 25 cents a barrel and then so low it would not pay to handle it. The tar and pitch manufactured at first gave general satisfaction and were made in large quantities. In 1770 there were nearly 100,000 barrels of tar and pitch shipped from the United States, about one-fifth of this amount being pitch shipped from North Carolina.

In 1799 the tar used in England came in equal proportions from Russia, Sweden and the United States. Later the Carolina tar and pitch were less esteemed in England, where they were said to burn the cordage more than the products made in the Baltic provinces. This was said to be due to dead wood being used in North Carolina for making tar and the burning being carried on so rapidly and at so high a temperature that wood acids were formed in large quantities along with the tar. American products were also objected to because they were earthy, the receptacle being carelessly made, and were packed in insecure, leaky barrels. These last objections are sometimes made against them now, though the use of cases for shipping has tended to remedy the evil.

In Bothnia and Sweden, on the other hand, only living wood of the fir and usually from the lower part of the trunk and roots were used and burning was carried on more slowly. In 1831 there were imported into England 10,900 lasts of tar, of 14 barrels each. Of these 8,700 came from Russian provinces on the gulf of Bothnia, 1,200 from Sweden and only 1,000 from the United States. The amount imported from the United States has remained at very near these figures ever since.

The total value of the resinous products shipped from the United States, however, increased from about $200,000 in 1800 to $567,000 in 1834, and to $700,000 in 1838. Most of the products shipped up to this time were from North Carolina, as previous to 1838 trees were not tapped for turpentine south of the Cape Fear river, it being a generally held opinion that south of that river the pines would not yield. This error was soon discovered by experimenting with the trees in that section and orchards there soon became as valuable as those farther north.

In 1836 copper distilleries were introduced in this country and at the same time there was an increased demand for spirits turpentine as a solvent of India rubber, this being the cheapest solvent of that article obtainable, and was thus used in the manufacture of rubber goods. It was also used for illuminating purposes, though the different forms of petroleum oils and the general use in towns of illuminating gas, made from coal, soon supplanted it. Stimulated by this increased demand the production of turpentine extended rapidly southward beyond the Cape Fear river into South Carolina, and up the Cape Fear to Cumberland and Harnett counties. The British free-trade measure in 1846 gave free entrance into English ports to the products manufactured from turpentine and this stimulated the manufacture of these products in North Carolina. From this date forward the exports of crude turpentine decreased as the exports of spirits turpentine, rosin, tar, etc., increased.

It was found more economical to move the stills as close to the seat of production as possible, so that when rosin was low in value the spirits of turpentine only need be shipped. This allowed work to be done farther from the water-courses, near to which the industry had been previously confined. By 1855 about one-half of the spirits of turpentine shipped from Wilmington was distilled inland. The shipments from Washington and Newbern had already begun to decline, the building of the Wilmington and Weldon Railroad having largely turned their trade toward Petersburg and Wilmington.

By 1860 the orchards from which Washington drew its supply approached exhaustion and production soon ceased. Newbern being farther south, the industry continued there for several years longer, but after 1870 the decline in production became rapid and practically ceased during the past decade. There is now no distillery in full operation within thirty miles of Newbern. North of the Neuse river there were in 1893 only eight distilleries in operation, with an output for that year of less than 7,000 barrels of rosin. Three of these distilleries were in Johnston, two in Nash, two in Wilson and one in Wayne county.

SOUTH-WESTWARD EXTENSION OF THE INDUSTRY.—After 1835 the seat of the production of turpentine began to move south-westward through the Southern States. In 1840 the value of the total product amounted to $593,451, nearly the entire amount being produced in North Carolina; and in 1860, while the value of the total product in the United States was $7,454,000, that of North Carolina was $5,355,778. In 1870 North Carolina, with 147 establishments, manufactured naval store products valued at only $2,338,000, while the total product of the United States, with 227 establishments, amounted in value to $3,585,000. In 1893 Georgia made about the same amount of turpentine and rosin that North Carolina did, while Florida, Alabama, Mississippi and Louisiana altogether made about as much more.

The industry has only become of importance in Mississippi and Louisiana during the past few years, and is still capable of great expansion in these States. The turpentine orchards of Georgia are in about the same condition as those in this State, although there is probably in Georgia more round timber standing. The same may be said concerning the forests in Alabama. There are in Texas, however, between 3,000,000 and 4,000,000 acres of untapped long-leaf pine forests and the turpentine industry there has hardly more than made a beginning.

INLAND EXTENSION IN NORTH CAROLINA.—The first turpentine distillery at Fayetteville was established in 1844 by Thomas Lutterlow. The same year the first boxes were cut in what is now Harnett county, near Manchester, by Henry Harrison, who shipped the turpentine from there to Fayetteville to be manufactured. Ten years later there was a distillery owned by Jonathan Worth & Son in operation in the extreme western part of Harnett county near Buffaloe Springs.

The building in 1850 of a plank road from High Point to Fayetteville, which road was followed in a few years by a similar one from Fayetteville through the western section of Cumberland county and another which was projected to Raleigh through Harnett and Wake counties, but only partially finished, caused Fayetteville to become the seat of a large business both in handling turpentine and rosin and in distilling the crude turpentine. The satisfactory prices obtained, and the facility with which the produce could be gotten to Fayetteville on the plank roads for shipment down the Cape Fear river to Wilmington, led to the industry's extending before the outbreak of the civil war, even to the very western limits of the pine belt in Chatham, Wake and Moore counties.

The completion, subsequently, of railroads across the western part of the long-leaf pine belt caused a great deal of the rosin and spirits, manufactured along their lines, to be shipped direct to Northern and other inland consumers, without going *via* Wilmington. In 1893 over 5,000 barrels of rosin went direct west by way of Paint Rock, and over one-half as much went direct north or to Norfolk by rail, as was shipped by way of Wilmington. Although the output of rosin and spirits of turpentine has more than doubled in the United States since 1860, the demand has increased nearly as rapidly until within the last few years, when there has been overproduction and consequently low prices.

VALUE OF THE NAVAL STORE PRODUCTS OF THE UNITED STATES.

From the Eleventh Census the total value of the naval stores manufactured in the United States for the year ending May 31, 1890, was $8,077,379. The product that year consisted of 346,524 barrels of spirits of turpentine, 1,429,154 barrels of rosin, and about 40,000 barrels of tar, pitch and miscellaneous products. The turpentine products given above represent the entire amount produced in the world for commercial purposes with the exception of that made in southern France and Austria, which altogether did not amount to 25,000,000 pounds (about 100,000 barrels).

AMOUNT OF CAPITAL AND LABOR EMPLOYED.

The cost of the crude material used to produce the output of naval store products in the United States in 1890 was $2,506,440, and the capital directly invested in the manufacture of naval stores in the United States was reported by the Eleventh Census to be $1,117,265, and in North Carolina $269,341. This capital, representing 670 establishments, employed 15,313 laborers in the United States and 1,747 laborers, on an average, in North Carolina, where there were reported to be 194 establishments.

The relatively small number of laborers given as employed in this State is due to the fact that the greater part of the turpentine is collected by farmers (or their "hands") who have a small area of turpentine orchard and utilize their time at dull seasons in this way; and many of these are not included in the above estimate. But some of the turpentine collected in other States is also gotten in the same manner.

CONDITION OF THE NAVAL STORE INDUSTRY IN NORTH CAROLINA.

During the latter part of 1893 the Geological Survey made an examination into the condition of the naval store industry in North

Carolina, and particularly into the condition of the turpentine orchards and the prospects of this industry in the State. The statistics for 1893 relating to this industry, which are given below, have been secured by correspondence with naval store dealers and distillers in all parts of the long-leaf pine region and by personal visits to many sections. The figures used in comparisons have been derived from the latest U. S. Census reports, unless credited to other sources.

SPIRITS TURPENTINE AND ROSIN STATISTICS.

The accompanying table shows for the year ending December 31, 1893, the number of turpentine distilleries in operation during the year, and the amounts of rosin and turpentine manufactured in each county, together with the amounts shipped from each county to Wilmington, N. C., and the amounts shipped direct by rail routes to consumers and dealers elsewhere.

Yield of Rosin and Spirits Turpentine in North Carolina, 1893.

COUNTY.	NUMBER OF DISTILLERIES.	ROSIN MANUFACTURED.			SPIRITS OF TURPENTINE MANUFACTURED.		
		Barrels shipped to Wilmington.	Barrels shipped by rail elsewhere.	Total number of barrels.	Casks shipped to Wilmington.	Casks ship'd by rail elsewhere.	Total Number of casks.
Bladen	27	39,800	3,600	43,400	7,500	990	8,490
Brunswick	8	12,000	....	12,000	2,800	....	2,800
Columbus	26	37,200	....	37,200	7,750	....	7,750
Cumberland	24	21,000	15,000	36,000	3,200	3,961	7,161
Duplin	5	7,800	....	7,800	1,060	....	1,060
Harnett	9	3,700	9,050	12,750	400	2,335	2,735
Johnston	10	....	16,764	16,764	....	2,632	2,632
Montgomery	12	....	22,000	22,000	....	5,150	5,150
Moore	34	3,125	38,207	41,332	200	8,637	8,837
Onslow	12	12,600	2,700	15,300	2,700	450	3,150
Pender	8	10,400	....	10,400	2,060	....	2,060
Richmond	13	7,170	6,017	13,187	1,800	1,083	2,883
Robeson	28	30,200	9,910	40,110	4,712	3,233	7,945
Sampson	30	41,000	3,000	44,000	7,920	2,121	10,041
Wayne	3	....	3,970	3,970	....	517	517
*Other counties	7	4,000	7,768	11,768	800	1,517	2,317
Totals	256	229,995	137,986	367,981	42,902	32,626	75,528

*This includes four counties: Nash with 2 distilleries, Wilson with 2, Lenoir with 2 and New Hanover with 1. The amounts included in this statement for New Hanover county are estimates obtained by adding the average yearly output of one distillery.

The number of counties which produced crude turpentine during the year (1893) was 19. The amounts produced in New Hanover, Nash and Wilson were very small, New Hanover producing practically none. The greater part of the crude turpentine which was manufactured in that county was brought from South Carolina, and from inland counties along the Cape Fear and Northeast Cape Fear rivers.

The total amounts of rosin and spirits of turpentine manufactured in North Carolina and their values are shown in the accompanying table for the year 1893 and the census years ending May 31, 1870, 1880 and 1890 as reported by the United States Census for those years.

Quantity and Value of Rosin and Spirits Turpentine Manufactured in North Carolina.

YEAR.	Number of establishments.	ROSIN.		SPIRITS OF TURPENTINE.		Total value.
		Barrels.	Value.	Casks.	Value.	
1870	147	....	....	....	....	$2,338,309
1880	184	....	....	....	....	1,758,488
1890	194	365,233	$377,310	72,888	$1,293,086	1,705,833
1893	247	367,981	392,000	75,528	1,283,760	1,752,760

The total values represent the value of all products manufactured directly from turpentine.

Production has ceased during the past ten years in Wake, Craven and Edgecombe counties. There has been an increase since 1880 only in Moore and Montgomery counties, the number of barrels of rosin produced in Moore county for the year (1893) being considerably larger than the number produced in 1880, though the value of the product is less now than at that date. Montgomery county is credited with no resinous products in the census of 1880, but in 1893 there were 12 distilleries operating there which produced 22,000 barrels of rosin.

DECREASE IN THE PRODUCTION OF CRUDE TURPENTINE.

The quantity of crude turpentine shipped is small now compared with past shipments. All that was shipped last year went direct to domestic consumers, mostly manufacturers of printing and lithographic inks. Boston was the largest market, New York and Baltimore being next in order. There were 6,331 barrels shipped from Wilmington and 4,600 barrels from other points, making a total of 10,931 barrels, with an estimated valuation of $12,000. The grades of this crude turpentine were not obtainable.

The general decrease in the amount of crude turpentine produced in the extreme eastern counties during the past twenty years is approximately shown by the decrease in the exports of rosin and spirits turpentine from Wilmington. This will not apply to the more westerly counties and to Harnett, Johnston, Cumberland and Robeson, since additional railroad facilities during the past ten years have turned a large part of their products from Wilmington. In a few of these counties, as in Montgomery and Moore, the product has increased considerably of late, owing to better railroad facilities, but this product is largely transported direct to Northern markets and does not enter into this statement of exports from Wilmington.

The total exports of rosin and spirits of turpentine from Wilmington for every year since 1872, as shown by the records of the Wilmington Produce Exchange, were as follows:

Total Rosin and Spirits Turpentine Exported from Wilmington, 1873–'93.

YEAR	Exports of Rosin, Barrels.	Exports of Spirits of Turpentine, Casks.	YEAR.	Exports of Rosin, Barrels.	Exports of Spirits of Turpentine, Casks.
1873	690,151	131,236	1884	342,936	71,354
1874	556,182	125,837	1885	314,724	66,603
1875	523,330	107,420	1886	331,497	63,684
1876	490,555	91,592	1887	381,535	71,912
1877	537,704	101,832	1888	246,566	63,473
1878	581,958	118,176	1889	351,827	61,626
1879	512,891	91,224	1890	385,523	70,285
1880	447,750	101,725	1891	304,818	60,844
1881	486,138	87,658	1892	273,291	58,034
1882	444,318	87,896	1893	224,070	47,228
1883	453,465	82,135			

When the exports of 1883, for both rosin and spirits of turpentine, are compared with those of 1873 there is shown a falling off of over one-third, while there is a falling off of nearly one-half in the decade between 1883 and 1893.

Many distilleries in the extreme eastern counties reported that their territory had not been thoroughly worked, during the last few years, on account of the low prices, and that any rise in prices would largely increase production. This fact may in part account for the more rapid decline in the receipts of rosin and spirits of turpentine at Wilmington since 1883.

The following table gives the foreign exports of rosin and spirits of turpentine from Wilmington and their value for the past ten years. The data were kindly compiled from the records of the custom-house at Wilmington, for the Survey, by Mr. J. M. Cronly, Deputy Collector of that port:

Quantity and Value of Foreign Exports of Rosin and Spirits Turpentine from Wilmington, N. C., 1874 and 1884-'93.

YEAR.	FOREIGN EXPORTS OF ROSIN.		FOREIGN EXPORTS SPIRITS TURPENTINE.	
	Barrels.	Value	Gallons.	Value.
1874	248,424	$..................	2,530,000	$..................
1884	300,932	405,776	1,418,848	470,644
1885	290,165	348,849	2,375,482	689,964
1886	288,499	306,538	2,139,091	732,642
1887	333,119	338,356	2,203,457	757,398
1888	311,613	341,825	1,988,103	695,476
1889	281,251	296,987	1,630,795	641,025
1890	302,094	394,569	1,751,270	709,988
1891	296,918	426,007	1,473,157	565,834
1892	251,853	271,394	1,080,231	372,534
1893	231,056	299,286	918,727	256,178

While the foreign exports of rosin have varied but little there has been a steady decline in the amount of spirits of turpentine shipped.

THE ROSIN TRADE.

The bulk of the rosin made in the United States is used in foreign countries, England importing the larger part of it. About two-thirds of the amount manufactured in North Carolina last year went to Europe, and the remainder to domestic consumers. Domestic manufacturers use more of the fine grades of rosin made in this State than foreign manufacturers do. An attempt was made to ascertain the amounts of the different grades of rosin manufactured, but returns as to this point were frequently imperfect. There were, however, about 4,800 barrels of W. W. and W. G. rosin (the two highest and lightest colored grades)* shipped by rail from the western counties of the pine belt, and about 4,000 barrels of the same grades were shipped to Wilmington, from the more eastern counties of the pine belt. There were about 20,000 barrels of other grades of light rosin (above N.) made in the western counties, and shipped by rail, and about 25,000 barrels of these grades made in the more eastern counties and shipped *via* Wilmington. It seems that, while Wilmington handled nearly two-thirds of the rosin manufactured in North Carolina it only received about one-half of the finer grades of rosin. Practically all of the finer grades of rosin which were received at Wilmington, during the year 1893, were sent to Europe.

EXPORTS OF TAR AND PITCH FROM NORTH CAROLINA.

Exports of tar and pitch from North Carolina have varied during the past twenty years much less than have those of rosin and turpentine. The exports, both foreign and domestic, of these commodities from Wilmington for the years 1874, 1884 and 1893 were as follows:

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*GRADES OF ROSIN.—The commonly recognized grades of rosin in the United States are as follows: "W. W."—water white; "W. G."—window-glass; "N."—extra pale; "M."—pale; "K."—low pale; "I."—good No. 1: "H."—No. 1; "F."—good No. 2; "E."—No. 2: "D."—good strain; "C."—strain; "B."—common strain; "A."—black.

"Water white" and "window-glass," which are the lightest colored and highest priced rosins, are made only from the "virgin dip," and usually only from that gathered during the first parts of the season. The virgin dip is the turpentine taken from the boxes the year or season that they are cut. The last dipping of the first season (the boxes are dipped from six to eight times during a season) give a yellowish turpentine which makes rosin of about the grade "N." The second and succeeding years "yellow dip" is obtained, the turpentine having acquired a decided yellow tinge of color from running down over the face of the tree which was hacked during the preceding summer when it comes in contact with the old and dark-colored resin on its surface, and is subject to the evaporation of the volatile oils in it by being longer exposed to the heat of the sun.

The second year's yellow dip makes usually rosin of the grade "N." during the first part of the season, while only darker grades "L." and "M." are gotten during the latter part of the season, Each year that the boxes are worked the dip becomes more colored, yields a darker rosin, and has less spirits of turpentine in it on account of having to run down a larger surface, covered with colored resin, and be exposed for a longer time to the oxidizing influences of the sun and air. The "scrape," which is the hardened resin adhering to the scarified face of the tree, yields the darker grades of rosin. The common grades are made from old scrape on trees which have been worked several years, and frequently has mixed with it sticks and chips, cut from the tree while the hardened scrape was being removed. The turpentine produced from the lighter colored dippings is of a better quality than that from the darker, being purer and lighter and having less rosin oil in it.

A large part of the dark grades of rosin ("strain" and "common") which are exported to Europe are used in manufacturing rosin oil. The finer grades are used in the manufacture of soaps, paper sizing, etc.

Total Exports of Tar and Pitch from Wilmington.

YEAR.	Tar, Barrels.	Pitch, Barrels.
1874	68,619	7,400
1884	68,794	5,734
1893	52,541	3,274

In 1893, besides the above, 4,600 barrels of tar and 700 barrels of pitch were shipped North by rail from Robeson and Cumberland counties. This makes a total of 57,100 barrels of tar and 4,000 barrels of pitch, with an estimated value of $65,000. The foreign exports of tar and pitch from Wilmington, for the years 1873, 1884, 1893 were as follows: In 1873 they were 48,200 barrels; in 1884 they were 20,138 barrels; in 1893, 7,740 barrels. This shows a decline in the foreign exports of more than 50 per cent. during each decade.

TOTAL AMOUNT AND VALUE OF NAVAL STORE PRODUCTS IN NORTH CAROLINA, 1893.

The total amount and value of the naval store products shipped from North Carolina during the year 1893 were approximately as follows:

Amount and Value of North Carolina Naval Store Products, 1893.

75,528 barrels of spirits turpentine	$1,283,760
367,981 barrels of rosin	392,000
10,931 barrels crude turpentine	12,000
63,100 barrels tar and pitch	65,000
Total value of products	$1,752,760

A preliminary report of the Eleventh Census estimates the total products for North Carolina for the year ending May 31, 1890, to have had a valuation of $1,705,833. No crude turpentine is given in that report and the tar is given at 600 barrels, valued at $847 for the entire State. This statement is evidently incorrect, since the exports of that product from Wilmington alone amounted to

72,000 barrels for the year 1890 and almost as much for the preceding year.

CONDITION OF THE TURPENTINE ORCHARDS IN NORTH CAROLINA.

As bearing on the future supply of resinous products in North Carolina, a close examination was made into the condition of the long-leaf pine forests now standing in the State, and in the following notes the writer has endeavored to show the character and extent of the existing productive orchards, of those orchards which have been abandoned, the round timber which can be boxed, and the second growth long-leaf pine.

LENGTH OF TIME THAT TURPENTINE ORCHARDS ARE WORKED.

The orchards of the Cape Fear river section have been worked steadily for from twenty to thirty-five years and in Sampson and Bladen counties many bodies of pine are reported as having three sets of boxes on them, having been worked since 1845, with intermissions of a few years for rest and to allow the space between the hacked faces to increase in breadth. The yield from these long-worked trees is still considerable when they grow on good soil, and when the trees have been injured in no other way, as by fire charring the faces of the old boxes.

These trees along the Cape Fear river seem capable of standing continuous working longer than those in any other part of the State or even of the United States, there being numerous reports from this section stating that the orchards had been worked from forty to fifty years. From Columbus county only one distiller reported that his trees had been worked as long as thirty-five years, while others stated that theirs were abandoned after having been worked from twenty to twenty-five years. One distiller in Robeson county, on the Cape Fear river, reported fifty years as the maximum time, while for those farther west, in Moore county, approaching the clay uplands and at an elevation of from 300 to 500 feet above the sea-level, a productive limit of twenty years was given. In South Carolina the trees are worked from twelve to fifteen years; in Georgia from four to eight years, except the slash pine (*Pinus* *cubensis* Griseb.) along the coast, which "runs dry" in one or two years, as is true of the loblolly pine in North Carolina.

It may be said that most of the orchards now producing in North Carolina have been "back-boxed"* and that over four-fifths of the crude turpentine comes from back-boxed trees. Only in Montgomery and the western parts of Moore county are there any extensive bodies of trees which have not been back-boxed. The average time the trees have been worked in these two counties is about seven years, but many of the orchards in Montgomery have only been worked for four years.

AREAS OF ABANDONED TURPENTINE ORCHARDS.

An examination of this region showed that large areas of long-leaf pine forests had been abandoned as no longer profitably yielding turpentine. Such areas, where the trees are still standing, are classed by the distillers as *abandoned orchards*. When these forests have been removed by fire or cut by lumbermen and no loblolly pine has appeared to take the place of the long-leaf pine, the term *waste land* is applied to these areas. The following estimates of the amounts of abandoned orchards in the separate counties are based on returns made by 162 distillers in these counties, supplemented by personal investigation by the writer. These areas, in acres, of abandoned turpentine orchards were as follows in December, 1893:

Areas of Abandoned Turpentine Orchards in North Carolina, 1893.

Bladen county	60,000 acres.	Onslow county	38,000 acres.
Brunswick	98,000 "	Pender	28,000 "
Cumberland	51,000 "	Richmond	32,000 "
Duplin	17,000 "	Robeson	63,500 "
Harnett	52,000 "	Sampson	58,500 "
Lenoir	20,000 "	Wayne	30,000 "
Johnston	30,000 "	Wilson	20,000 "
Montgomery	10,000 "	Other counties	75,000 "
Moore	10,000 "		
Nash	25,000 "	Total in the State	718,000 "

Included in the term "other counties" are Wake, Edgecombe, Craven, Columbus, New Hanover and Carteret counties. The amount abandoned during the past few years has been greater than usual, the very low prices making it unprofitable to work thinly timbered orchards longer. The operation of many of these bodies may be resumed should there be any material advance in prices of naval store products, but such a change is hardly probable. In these areas of abandoned orchards there is a great range of density of forest growth, varying from that which may be called the normal density, which will cut from 3,500 to 4,500 feet, board measure, to the acre, to that which will scarcely cut 300 feet to the acre, below which latter limit it would be considered *waste land* unless a growth of loblolly pine has, in part, replaced the long-leaf pine. Although there is very little of this abandoned orchard that is heavily timbered with long-leaf pine, all of it has, more or less, valuable mill timber on it. Much of the timber might again be boxed and profitably worked if protected until the growth of the space between the boxes would allow new boxes to be cut.

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*For explanations of this and other terms see pp. 94—96.

ANNUAL ADDITIONS TO THE TURPENTINE ORCHARDS.

The number of acres of round timber being boxed yearly is now very small. An attempt was made to ascertain this amount, but both *back boxes* and *original boxes* were included in the returns; these figures, too, were somewhat fragmentary for certain districts. For the seasons 1892–'93 and 1893–'94 the *total number of boxes* cut in each county were about as follows:

Number of Boxes Cut in North Carolina, 1892–'94.

COUNTY.	Season 1892–'93.	Season 1893–'94.	COUNTY.	Season 1892–'93.	Season 1893–'94.
Bladen	86,000	95,000	Nash	60,000	60,000
Brunswick†	10,000	....	New Hanover*	....	....
Columbus	60,000	70,000	Pender	33,000	22,000
Cumberland	255,000	220,000	Onslow	35,000	18,000
Duplin†	11,000	4,000	Richmond	90,000	65,000
Harnett	82,000	70,000	Robeson	197,000	96,500
Johnston	35,000	42,000	Sampson	114,000	105,000
Montgomery	35,000	60,000	Wayne	7,000	3,000
Moore	83,000	78,000	Wilson	....	....
Lenoir†	....	3,000			
			Totals	1,193,000	1,011,500

*No returns made. †Returns not full.

It can be roughly estimated that it would require the trees on 20,000 acres to hold the number of boxes cut in 1893–'94. The proportion of this which was round timber, and which represents the increase in the area of orchard, was under 3,000 acres. The largest single tract ascertained to have been newly boxed was 350 acres in Bladen county. There were other tracts nearly as large in Sampson, Harnett, Richmond and Montgomery counties.

BOXING OF OTHER SPECIES OF PINES.

The loblolly and short-leaf pines are not generally tapped in this State. An attempt was made, however, to find out the number of loblolly pine (*P. Taeda*) boxes cut last year in Johnston and Robeson counties, where most of them are worked, and the number was found to be under 20,000, showing that a very insignificant amount of turpentine is produced from this tree. There were about 3,000 short-leaf pine (*P. mitis*) boxes cut last year in Montgomery county. This tree was extensively worked fifteen years ago in Wake and Chatham counties. The young trees are the only ones which yield sufficiently to justify boxing; they yield about two-thirds as much crude turpentine as the long-leaf pine and can be worked from six to seven years. The crude turpentine from the loblolly pine is very thin, and runs so freely that it usually overflows the box and runs down to the ground, unless the boxes are dipped more frequently than the long-leaf pine boxes are. It is said to have so much water in it that when distilled without a large intermixture of crude turpentine from the long-leaf pine only a poor quality of spirits turpentine is obtained.

AMOUNT OF ROUND TIMBER AVAILABLE FOR BOXING.

This name is given to the original growth of long-leaf pine before it has been boxed. It makes, of course, better mill timber than the boxed trees, which have the lower part of the stock around the face of the boxes surcharged with resin, obliterating all signs of the grain and making what is called lightwood. The amount of round timber, in acres, standing in each county December, 1893, was, as nearly as could be determined, as follows:

Amount of Round Timber (Long-leaf Pine) in North Carolina, December, 1893.

Bladen	3,900 acres.	Nash	700 acres.
Columbus	3,700 "	Onslow	3,200 "
Cumberland	1,300 "	Pender	5,400 "
Duplin	1,900 "	Richmond	2,200 "
Harnett	6,100 "	Robeson	6,850 "
Johnston	200 "	Sampson	876 "
Jones	400 "	Wake	700 "
Lenoir	1,500 "	Wayne	200 "
Montgomery	6,050 "		
Moore	10,700 "	Total for the State	55,876 "

The total amount of round timber now standing is very little more than was yearly being put in orchard during the period between 1840 and 1870. The number of acres of round timber standing in these same counties fifty years ago must have been between 4,000,000 and 5,000,000 acres. Much of this remaining timber will probably never be boxed, being in small bodies in districts where trees have ceased to be worked for turpentine.

YOUNG GROWTH OF LONG-LEAF PINE.

The young growth of long-leaf pine may also be included along with the round pine as timber which in part now, or in the near future, can be worked for turpentine. But unfortunately the acreage of second growth pine which is now, or even soon will be, of sufficient size to be boxed for this purpose, is very small, and the trees in such growth are scattering, consequently they are short-bodied and present little uniformity as regards size or regularity of growth. The figures for this acreage are based on field notes taken during an examination of the pine lands during the winter of 1893–'94. In each case they are probably much in excess of the true amount of young growth of trees large enough to hold a turpentine box. The counties in which any large amount of young growth was observed and the approximate amounts of this in each (in acres) are enumerated in the accompanying table:

Areas of Young Growth of Long-leaf Pine in North Carolina, 1893.

Bladen county	3,500 acres.	New Hanover	4,000 acres.
Craven	5,000 "	Robeson	2,000 "
Cumberland	2,700 "	Sampson	2,500 "
Moore	700 "	Others possibly	10,000 "
Lenoir	2,000 "		
Johnston	700 "	Total in the State	33,100 "

Some of this young growth has already been boxed, but the amount of turpentine gotten from it is inconsiderable. It varies in age from about eighteen to thirty-five years, and in diameter from four inches to eighteen inches. The amount of young growth loblolly and short-leaf pine is very large, should the price ever allow them to be extensively worked for turpentine.

DECREASING AREA OF TURPENTINE ORCHARDS IN NORTH CAROLINA.

As shown in the above statements the additions to the areas of turpentine orchards during the past few years, from both the taking in of new mature forests and the boxing of young or second growth pine trees has been small. On the other hand, the destructive agencies, such as forest fires, storms and the lumbermen, have been actively at work, and as the result of their combined activities the area of productive turpentine orchards in North Carolina has been reduced to but a small part of what it was half a century ago. Over the large areas north of Neuse river the long-leaf pine has practically disappeared. Over large areas between this river and the South Carolina State boundary line many of the once dense virgin long-leaf pine forests have given place to equally large areas of abandoned pine barrens and waste lands.

DESTRUCTION OF ORCHARDS BY FIRES.

Every year there is more or less destruction of standing timber by fires, both in worked and in abandoned orchards. The loss during the past year and the number of acres burnt over are shown with approximate accuracy in the accompanying tabulated statement:

Some of the Losses from Fires in Long-leaf Pine Forests, 1893.

LOCALITY.	No. of Acres Burnt.	Loss.
Moore county	30,000	$25,000*
Cumberland	10,000	12,000†
Robeson	5,000	6,000
Six other smaller fires	3,500	5,000
Totals	48,500	$48,000

*Estimated by W. E. Petty, Esq., Carthage, N. C.

†Estimated by Mr. John Blue, of Aberdeen, N. C.

All of these fires took place in the spring, either in March or April, and all were reported as started from the firing of the grass of the pine barrens. The first two fires were particularly severe, going through orchards that were being worked, and ruining not only the boxes, but also killing a great deal of the timber, very little of which was so situated that it could be converted into lumber before being attacked by the borers.

In the fall of 1892 there was another severe fire in Richmond and Moore counties, which destroyed a large amount of timber, and also the village of West End, on the Aberdeen & West End Railroad. The value of the timber alone destroyed by this fire was placed at $75,000.

The danger and loss occasioned by fires in the forests is not sufficiently understood by the class of persons who are generally the cause of them. In the pine barrens most of the fires are purposely started, and the persons starting them should be held responsible for any loss caused by them. Too great discretion cannot be exercised about a suitable time to burn the woods, when it is deemed absolutely necessary to burn them, and persons should be careful that it is not too late in the season: after the trees have begun to put forth their leaves or shoots, and that the season is not too dry. Much care should be taken to prevent such fires escaping proper bounds and destroying the property of other persons who are in no way connected with the starting of the fire.

The damage of fires is more than local and the loss occasioned by them, or resulting from them, is felt far beyond the immediate district in which they occur. Even when there is no apparent damage it sets a precedent, the following of which is sure ultimately to lead to great damage. And there is always a considerable amount of damage done; enough to far more than counterbalance the advantages supposed to be gained in improving the pasturage of the forests or in other ways.

The illustration (Plate I) facing page 58 is from a photograph of a long-leaf pine forest a few miles west of Southern Pines, Moore county, taken some months after a forest fire had swept through this region. All of the pines at this point were killed. Many of them fell and were partially or completely destroyed, and the few left standing were practically ruined, as they could not be cut at once. (See, also, pp. 57 and 61 for notes on the destructive work of forest fires).

DAMAGES TO ORCHARDS FROM STORMS.

Besides the injuries to turpentine orchards, during 1893, from fires they were damaged by two severe storms, occurring one in August and the other in October, in the fall. The earlier storm, in August, did but slight damage, except to abandoned orchards. The one of October 14th, however, proved generally destructive to all boxed pines, besides blowing up by the roots many oaks and other hardwood trees. The damages were greater in the south-eastern portions of the State, especially in Columbus, Bladen, Sampson and Johnston counties, but they were by no means confined to these counties. The force of the storm was not uniformly distributed over this area, but was more severe at numerous scattered points. Twenty distillers in these counties estimate that at least one-tenth of their trees were blown down, while other orchards were injured to a less extent, and several thousand acres of abandoned orchard were ruined.

Most of this fallen timber proved to be a total loss, though about 100,000 railroad cross-ties were cut from it at points contiguous to the railroads, and small quantities of it were carried to the saw-mills on the Cape Fear river. Unboxed long-leaf pines suffered very little, and neither the loblolly pine nor swamp timber was damaged to any considerable extent. Boxed pines, as a rule, were broken off at the box. Out of one hundred prostrated long-leaf pines seen near Bladenboro (N. C.) eighty-five were broken off at the *box*, four above the box but along the *face*, ten were blown up by the roots, and only one tree was broken off above the face of the box. These facts show the importance of adopting some other system of gathering the turpentine which will avoid the deep boxing of the trees. Such a system is practiced in France, and is described further on in this report (page 96).

AREA OF ORCHARDS REDUCED BY LUMBERING.

Lumbermen are also instrumental to a considerable extent in reducing the acreage of turpentine orchards. In Moore, Richmond and Robeson counties they are rapidly cutting into the orchards. Eleven distillers in the two first counties reported their orchards as having been cut into by lumbermen last year. At least 35,000 acres of new and abandoned orchard must have been cut over during 1893 to have yielded the lumber cut during that year by the mills sawing long-leaf pine.

HOW LONG CAN OUR TURPENTINE ORCHARDS LAST?

It appears from the foregoing that there are in the State less than 75,000 acres of long-leaf pine timber now unboxed which can be added in the future to the turpentine orchards, and that the present yield of turpentine is derived principally from "back-boxed" trees, which if not destroyed within twenty years could not continue to yield turpentine for more than that length of time. In point of fact, however, the trees of existing orchards cannot produce turpentine, except in a small way, for even that length of time, since they are being destroyed by fire, or converted into lumber, at the rate of over 60,000 acres a year. Then, too, the rate of destruction increases each year as the number of mills increases, and as the amount of abandoned orchard, which proper precautions are not taken to protect from fire, becomes larger; and these abandoned orchards serve as means of carrying fire to the newer orchards which are being used.

FRENCH AND AMERICAN METHODS OF GATHERING TURPENTINE.

The two chief objections to the American system of boxing trees for turpentine are:

(1). The injury to the tree produced by the box, interrupting and impairing the life processes and sooner or later damaging the timber or causing its entire destruction, and,

(2). That the yield of spirits of turpentine is less than it should be, and the rosin manufactured is largely of darker and inferior grades.

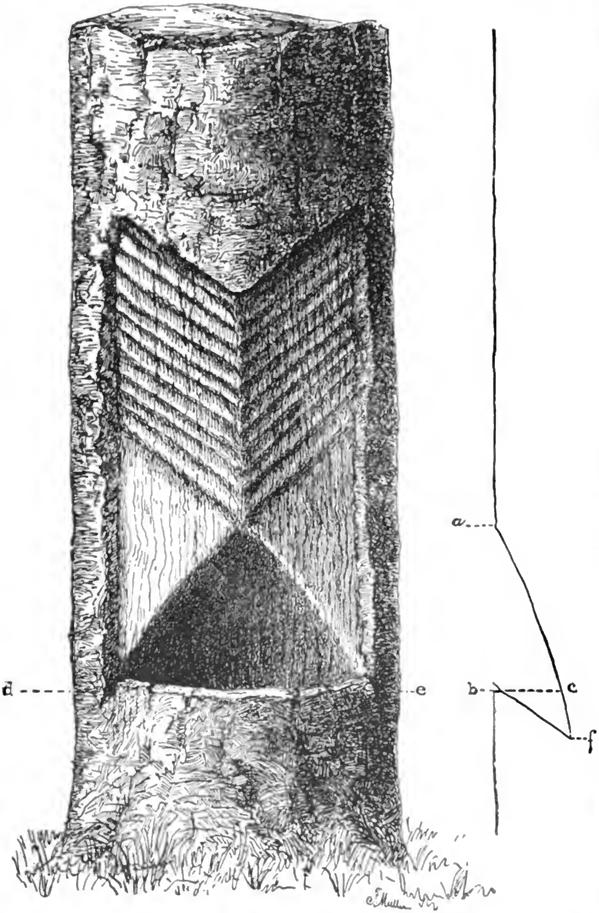
A method of tapping the trees, which to a very great extent remedies these faults, is the Hugues system, which was first used in France about 1860, and since that time has come into general use in that country, having been found more efficacious than the one previously used there. It presents as great an advancement on the American system now in vogue as the American did on the early French method.

THE AMERICAN SYSTEM OF GATHERING TURPENTINE.

The American method, which can be advantageously used only on stocks over fifteen inches in diameter, consists of cutting in the base of the tree, about eight inches from the ground, a hole called the *box*. This box, which is hollowed out with a narrow, thin-bladed axe manufactured for the purpose, has a length following the circumference of the tree of about fourteen inches (*d* to *e* of Plate II), a depth of about seven inches (*b* to *f*), and extends back into the wood at the mouth of the box about four inches (*b* to *c*), or at the bottom of the box (*f*) about five inches. At the same time that the box is cut there is a triangular strip removed on either side of it and extending up as high as the tip of the box. This operation is called *cornering* and the channels left where the chips were removed act as gutters leading into the box.

Immediately above this box the thin bark and a thin section of the sap-wood is removed by means of a sharp, bent-bladed implement called the *hack*. In this process, called *hacking* or *chipping*, the implement is drawn at an oblique angle across the surface of the trunk alternately in opposite directions, each pair of grooves made by the hack forming a V, so that the cut surface consists of two planes forming a very obtuse angle, the lines of their union running vertically up the tree above the center of the box, and down which line the resin runs into the box. This scarified surface, called the *face*, has a breadth of from fourteen to sixteen inches and a depth usually of one and one-half to two inches, rarely going in as deep as the thickness of the sap-wood.

The boxes are cut late in fall or early in spring, and in the first part of March chipping is begun, and is repeated about once a week for from thirty to thirty-five weeks, according to the



AMERICAN PRACTICE OF BOXING AND CHIPPING.
[FROM U. S. DEPT. AGR. REPT.]

length of the summer season and the way the resin runs. At each chipping about one-half an inch of wood is cut off. The resin lying in the resin ducts or pores, which are parallel with the grain of the wood, flows out when these ducts are cut and runs down into the box. The object of repeated chipping is to open a fresh surface for the exudation, when the ducts have become clogged by an accumulation in them of hardened resin. By the end of the first season the face has been carried up eighteen to twenty four inches above the box.

The resin which runs into the box, called *virgin dip* the first season, and the *yellow dip* of subsequent years is a thick, viscid liquid, more or less transparent and thinner the first season, but hardening quickly on exposure. During the first season it is removed seven or eight times from the box. That resin which hardens on the face is removed by a sharp *scraper* (*scraping*) and is mixed with chips and bark, and, besides containing only one-half as much spirits of turpentine as the dip, makes a much harder and darker and withal less valuable grade of rosin than the dip, much of the spirits of the scrape having evaporated or oxidized under the influence of light, heat and air. Each year as the face is carried up higher, about twenty inches a year, there is more scrape and less dip, as the resin exuding from the freshly hacked surface has to run over the entire surface which has already been hacked before it reaches the box, and a large proportion of it hardens and never reaches the box.

The *dip*, as has been explained, becomes, in succeeding years, gradually darker as work is carried on until it makes only a slightly better rosin than the scrape and contains only two-thirds as much spirits of turpentine as the virgin dip gotten the first year the boxes were worked. There will average two such boxes to a tree, the trees generally being about twenty inches in diameter. After the "faces" have been carried up so high that it is no longer profitable to work them, the trees are allowed to rest for several years and recuperate. During this time the sound wood left between the "faces" broadens, partly covering the old faces, so that on large trees new "boxes" can be cut in between the old ones and the trees again worked. This is called "back-boxing." There are frequently three sets of boxes put on one tree.

THE FRENCH SYSTEM OF GATHERING TURPENTINE.†

The original French method merely removed the bark and a thin layer of sap-wood from a space (face) about five inches wide on each tree, and the resin as it exuded after the repeated chippings ran into a receptacle placed at the foot of the tree to receive it, or frequently into a hole dug in the sand. By the latter method, which was very primitive, the turpentine was mixed with sand, the spirits was absorbed and only a poor grade of rosin was made from it.

The method adopted in 1860, when the production of turpentine was stimulated in France owing to the stoppage of American exports by the blockades during the civil war, was very much in advance of this. The new method, then adopted, may be described in general terms as follows: At the end of February the outer bark for a considerable height is removed on all trees which are to be tapped that year, leaving only a thin layer of bark over the sap-wood. This is to prevent loose bark from falling into the resin. At the first of March, with a peculiar-shaped implement resembling an adze with a bent handle and a curved blade, there is made near the foot of the tree an incision which is four inches broad, two inches high and only one-third of an inch deep. At the bottom of this incision a curved gutter of zinc or galvanized iron, which has a width of the hacked face and teeth on its inner edge, is driven into the wood. This gutter turns the more liquid resin, which flows down into an earthenware or zinc cup hung on a staple immediately below the gutter.

The accompanying illustration (Plate III), taken originally from Professor L. Boppe's work on Forest Technology, but here reproduced from the Annual Report of the Chief of the Division of Forestry, U. S. Department of Agriculture, for 1892, "represents a pine two hundred years old, with more than fifty scars or chips, without apparently any ill effects on the life of the tree."* Some

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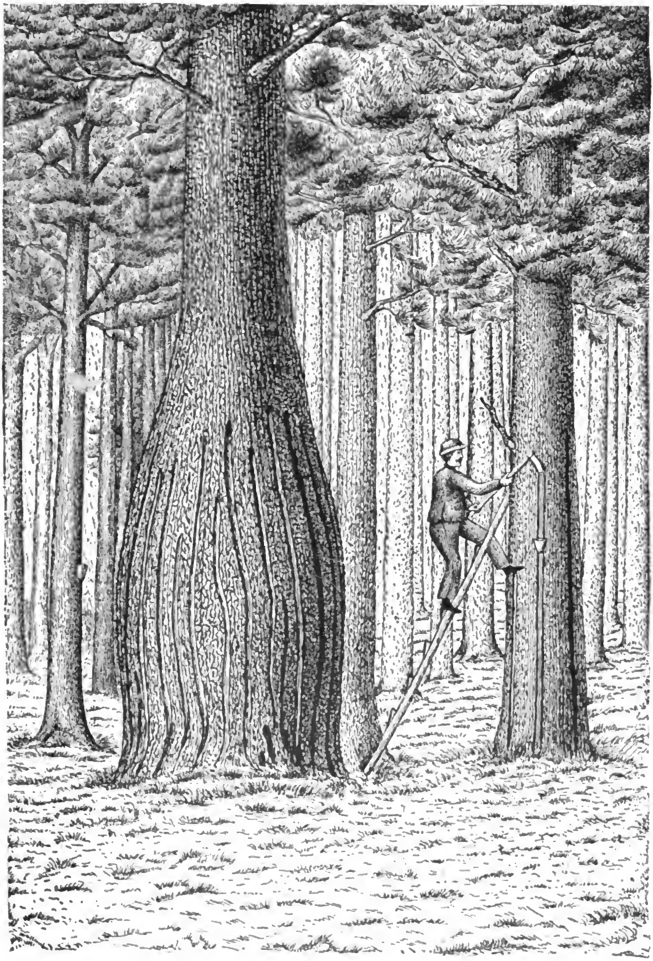
*An. Rept. Secretary of Agr., Washington, 1892, p. 345.



TURPENTINE ORCHARDING IN FRANCE.
[FROM THE U. S. DEPT. AGR. REPT.]

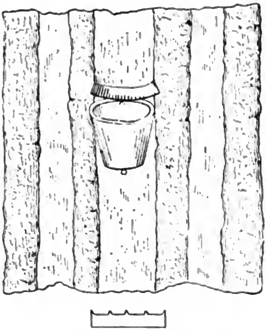


FIG. 1.—TURPENTINE GATHERING (FRENCH SYSTEM), TILL AND POT.

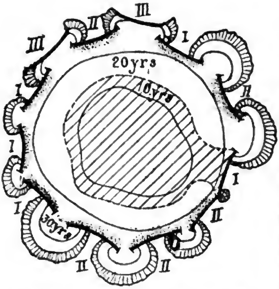


FIG. 2.—CROSS SECTION OF TURPENTINE TREE (FRENCH SYSTEM).

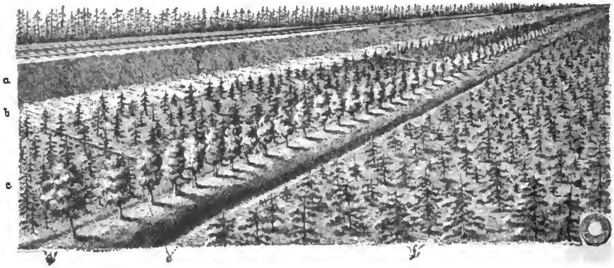


FIG. 3.—FIRE-SAFETY STRIP ALONG RAILROAD, FRENCH TURPENTINE FOREST.
[FROM U. S. DEPT. AGR. REPT.]

of the details of the method are more clearly shown in the figures 1 and 2 of Plate IV.

Figure 1 of Plate IV "exhibits the method of gathering turpentine by the Hugues system, and the use of the till and pot. While formerly the resin was allowed to run into a hole in the sand at the foot of the tree, since 1860, when the production was stimulated by the closing of the American sources of supply, an improvement on the crude method of collecting came into use. It consists in fixing a bent zinc collar or gutter cut from sheet zinc eight inches long and two inches wide, with teeth (see figure) across the chip, which acts as a lip, and conducts the liquid resin into a glazed earthen pot or a zinc vessel of conical shape suspended below the lip. The pots are six inches high, four and a half inches at the opening, and three inches at the bottom, and hold about one quart. At first placed on the ground they are fastened each season above the old chip by means of a nail through a hole or otherwise (see figure). In this way, by shortening the distance over which the resin has to flow, the evaporation of the oil is reduced and there is less liability of impurities to fall into the receiver. A cover over the pot is also sometimes used. The pots are emptied every fifteen or twenty days with the aid of a spatula. The scrape is collected only twice in the season, in June and November."*

Figure 2 of Plate IV shows a cross section of a pine tree treated according to the French method, bled at different places at different times. Some of the scars are nearly covered over with new wood (as at II), and two of the scars (as at III) have been recently made in new wood between older scars.

"Another improvement which reduces the amount of evaporation and assures cleaner resin consists in covering the chip with a board. This improvement (Hugues system) is said to yield more and purer resin, the yield is claimed to be about one-third larger, and the difference in price, on account of purity, 80 to 90 cents a barrel, while the cost per tree per year is figured at about one cent, besides the proportion of scrape is considerably reduced. This (called gallipot) is collected by hand, except the hardest impure parts (called barras), of which there is hardly any in this system of collection. Not more than 17.9 per cent. of scrape is expected, as against 29 in the American practice."*

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*An. Rep. Secretary Agr., Washington, D. C., 1892, p. 350.

Figure 3 of Plate IV "shows safety fire strip along railroad; *a* is the elevated roadbed, *b* is a strip of ground about twenty-five feet wide, which is cleared of all inflammable material. Alongside of this the wooded safety strip about fifty to sixty feet wide; *c* is a ditch five to six feet wide, a foot or so deep, the soil being thrown toward *d*. Cross ditches are made through the safety strip every 300 feet. The total width of the whole system of the road on either side is, therefore, eighty to ninety feet. The strip *b* may be used for agricultural purposes if fit for it; strip *c* remains wooded, but the forest floor is cleared out and freed of all inflammable material."†

Chipping is done forty to fifty times a season, and by the end of the first season the chipped surface has reached a height of twenty inches; that is, while the face is carried in one season just about as high in France as in the United States it is hacked from twelve to fifteen times more in the former country than here. This cup can be emptied easily and quickly by lifting it off the tree, and to prevent it being broken can be set aside while hacking and scraping is in progress, which latter operation is done once a year, in the fall. When work is begun on the second and subsequent years the cup and gutter are moved up and refastened so as to be just under the newly hacked surface. The face is rapidly carried up, the tree being hacked more frequently, but a much thinner chip being taken off than is required in the American practice, preserving all the time about the same width and same depth, so that at the end of five years it has reached a total height of twelve feet. From one to ten such faces are put on the pines, according to their size and age, and whether they are to be bled to death (*gemmage à mort*), in which event the timber will at once be utilized, or bled as long as the tree lives and an abundant flow of turpentine will permit (*gemmage à vie*).

These faces are worked only five years and then the tree is allowed to rest several years before new ones are put in. The new faces must be put in so that they will be four inches from any other

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*An. Rep. Secretary Agr., Washington, D. C., 1892, p. 350. †*Ibid.*

faces, in order that not enough of the inner bark and sap-wood will be removed at one time to kill the tree or seriously injure its life.

ADVANTAGES OF THE FRENCH SYSTEM.

The advantages of the French over the American system fall under two heads: (1). It tends more to protect the trees and prolong their activity. (2). It gives a larger yield, raises the grade of the resinous products and lessens the cost of producing.

RESULTS AS TO THE RELATIVE STRENGTH AND VITALITY OF THE TREES.

Under the French system no "boxes" are cut to weaken the trunk and make it liable to blow down, and in which, sooner or later, rot begins and finally destroys the timber value of the stem. It is in this American "box," too, always filled or covered with inflammable resin while the face is being worked, that fires usually get a start on the tree. There is no limit to the number of new sets of narrow French faces which can be placed, while from the weakening caused by the boxes only a limited number of sets of them can be cut. There are trees in the canton of Cormeau (France) which have been worked for more than 200 years and show over fifty scars. The scars of the narrow faces, although they may be over twice as numerous, are more quickly covered over by the growth of new wood on both sides, since the cambium or generative tissue just under the bark will have twice as many surfaces from which to develop. This enables a tree to more quickly regain its lost vitality, upon which the yield of resin largely depends. The shallow depth which the faces in the French practice are cut, only one-third of an inch, does not injure the life process so much as the deeper cutting practiced in America, which injures the growth of the tree about two-thirds, as is shown by a comparison of the thickness of individual rings of growth before and after boxing.

The purpose the French management has in view is to both preserve and work the forests intended for the production of turpentine as long a time as possible without serious injury to the trees, since it is a matter of both time and expense to grow a body of pines suitable for tapping.

THE YIELD BY THE FRENCH SYSTEM LARGER IN QUANTITY AND BETTER IN QUALITY.

By using the cup for collecting the turpentine and moving it up each year, so that it will be just below the freshly hacked surface, a larger quantity of purer and lighter colored dip is gotten than would be possible under the American plan, and the material thus collected corresponds always to the virgin dip; it is very free from bark and makes an exceedingly high grade rosin. Under this arrangement there is very little scrape, the surface hacked that season being all that has scrape on it. The increased production in France by use of the cup method amounted to four pounds of spirits of turpentine and seven pounds of rosin from every 100 pounds of crude turpentine, and besides there were no chips or trash of any kind in the crude material. The spirits of turpentine manufactured is of a better grade than that made from crude turpentine collected by the old method, being distilled at a lower temperature and with less heat, and all of the rosin, except a small proportion made from the scrape, is of a high grade.

The value of a barrel of the crude turpentine collected by the cups is about one-fourth greater than that collected by the former system. By the cup method there is also a large saving in labor, both in scraping and dipping, and there is no loss of turpentine in dipping from a box to a bucket.

RESULTS OF EXPERIMENTS WITH THE FRENCH SYSTEM IN NORTH CAROLINA.

During the season of 1894 a trial on a limited scale was made to test the merits of the French system and to ascertain by its direct application to the long-leaf pine the exact increase of turpentine collected by it above that yielded by the American practice.

In order to reduce to a minimum the chance of errors it was decided to conduct the experiments at three separate stations under direction of different persons. At two of these stations the turpentine was to be gotten from second-year boxes and at the third station it was intended to begin a trial with first-year or virgin boxes and continue the work here for several consecutive years to ascertain the comparative annual yield.

Unfortunately in one set of the experiments with second-year boxes the value of the results was vitiated by reason of a considerable loss of turpentine from the receptacles' overflowing. The results in this case will not be considered. Careful and conscientious attention seems to have been given the third set by the person in charge, and the results seem to be of sufficient importance to be given in full. The superintendence of this work during the season was in charge of Mr. Singletery, of Bladenboro, N. C., and it was near this village that the experiment was conducted.

The pines selected for tapping were in a grove with a medium density (about seven), and had an average circumference, breast high, of six feet nine inches. These were by no means the largest trees in this grove, but were selected on account of their vigor and apparent healthiness. The soil was fair, being a moist sandy loam. The forest floor was poor, being covered with a heavy growth of wire-grass, broom grass and low huckleberries. This strip had not been burnt in several years, and since the locality was isolated, being located in the neck of a small swamp, there was little likelihood that a fire would interfere in any way with the carrying out of the experiment. Boxes, usually two to a tree, had been cut in these trees in the previous spring and the trees "worked" for one season (1893), so that there were faces twenty inches in height on each tree. Those faces were from thirteen to fifteen inches broad. Six of these old boxes, with nearly southerly aspects and with faces unshaded by surrounding shrubs, were chosen as suitable for our purpose. Above each of these old faces two narrower faces (each six inches broad) were begun side by side. This method of placing the narrow faces gave each pair of them nearly the same aspect, and since, so far as could be seen, they were under similar conditions and of the same breadth, the amount of resin which flowed from each should have been the same. Six pairs of these narrow contiguous faces were begun above the broad ones on as many different trees, care being always taken that both narrow faces of any one pair were of the same breadth.

The surface of one narrow face of each pair was continuous with the surface of the face below, which was hacked during 1893, and the turpentine which exuded from the freshly chipped surface of this narrow face was allowed to run down the entire surface of the old face into the box cut at the foot of the tree.

Across the base of the other narrow face, which began at the upper edge of the old face, a metal gutter was driven into the wood. This gutter turned the turpentine into a metal cup which hung on a staple beneath it. Chipping was begun on these faces April 20th. Both of these narrow faces were hacked at the same time and the same number of chips were taken from each face, so that the length of both faces was kept equal. Both the metal receptacles and the boxes were emptied six times during the running season. The turpentine taken from the boxes was such yellow dip as is commonly collected from second-year boxes. The grade of the turpentine collected in the metal cups was virgin dip, exceedingly free from bark, leaves and chips. It will be understood, from the fact that each of the narrow faces had a breadth of only six inches, that from the six faces in either set there should have exuded only about as much turpentine as is usually collected from three of the large-size faces, fourteen inches broad.

The net weight of the turpentine collected by all of these boxes was 21 pounds; the net weight of that collected by the cups was 24 pounds and a few ounces; that is, by the use of the cups there was a gain of one-seventh in the weight of the dip collected; or had the faces been as broad as they are usually made there would have been during the summer a gain of one pound to each face. The yield of 7 pounds to a box from these picked trees is about one-fifth more than the average yield, which is only between 5.5 and 6 pounds to a second-year box. However, this is immaterial. What we are after is the percentage of the increased yield collected in the metal cups above that of the boxes. This increase was about 15 per cent. in favor of the cups. The application of this to a crop of turpentine would mean considerable aggregate gain and would show more clearly how large the gain really is.

Working out the increased yield on this basis, *i. e.*, one pound to each box, there would be a gain of 10,000 pounds of dip to a crop of 10,000 boxes, or a gain of 35.8 barrels of dip above the 250 barrels which 10,000 boxes would have produced had each box yielded 7 pounds; or there would be gotten, instead of the 250 barrels of yellow dip from the boxes, 285.8 barrels of virgin dip by use of the cups. The difference in the amount of scrape yielded by the two systems was not near so large as the difference in the amount of dip. This difference, of course, was in favor of the boxes and amounted to less than two pounds from all six of the boxes. This loss of a pound or more was due to the loss of volatile oil by evaporation and loss of scrape which hardened on the old faces. This difference in favor of the boxes would amount in a crop to nearly 23.5 barrels of scrape.

The advantage in favor of the cups, however, lays not only in the increased yield in pounds of turpentine, but also in the higher grade of product obtained by the cups. The value of the entire yield of a crop of 10,000 boxes as determined above would amount, at present prices, to about one-fifth more if collected by the cup than if collected in the boxes. This difference in value would be distributed as follows:

Value of 285.8 barrels of virgin dip at $1.70 per barrel,		$ 485 00
Value of 250 barrels of yellow dip at $1.50 per barrel.....	$ 375 00	
And value of larger yield of 23.5 barrels of scrape at $1.10 per barrel..........	26 00	401 00
Difference in favor of cups..........		$ 84 00

There is an increase in value amounting to $84, or over 20 per cent. gain, even when the cups are substituted in the place of second-year boxes, and the rate of increase in value of products becomes larger each succeeding year.

As in the other experiment both cups and boxes were tried on first-year faces, of the same length, no difference is expected in the result in favor of either system. It was intended, when this experiment was begun, to move the cups, at the middle of the season, up to the top of the face which had at that time been chipped. This should have yielded, in the cups, a slightly larger amount of dip turpentine than was collected in the boxes, and the grade of that in the cups should have been higher, since the dip turpentine collected from first-year boxes is usually classed as yellow dip for the last dippings of the season.

It is expected that these experiments will be continued next season (1895) on a larger and even commercial scale to make a further test of their adaptability. This will include a test of the cheapest and most serviceable collecting cups, the best breadth to make the faces, and a trial of different materials for making gutters to ascertain their durability and strength. The use of materials with minimum cost and maximum utility will of course determine the commercial practicability of the system and it is these subjects which it is hoped will be thoroughly investigated during the next year.

The incomplete results from another experimental trial, in which the cups, on first-year faces, were, at the middle of the season, moved up so as to be at the top of the face which had so far been cut, show a gain in the number of pounds of dip collected even larger than that obtained in the preceding trial. As no scrape was collected in this trial, from a misunderstanding with the person in charge, the weight of the scrape cannot be included. It can be said, however, that there was a large difference in the amount of scrape on the two sets of faces, much the larger amount of scrape having settled on the faces with boxes.

There were twelve faces in each set, the arrangements being similar to those stated in the above experiment, except that these faces were broader—from 7 to 7½ inches—and instead of the faces being cut in pairs, one of each kind, they were placed two on each tree without regard to their aspect. The net weight of the turpentine collected from the twelve boxes was 50½ pounds, and the weight of that collected from the cups was 59 pounds, which gives a net yield in favor of the cups of 8½ pounds, or a gain of over 16 per cent. No difference in the grades was noticed in the turpentine, both being classed as virgin dip.

COST OF ADOPTING THE FRENCH SYSTEM.

The cost of the change from the old French method to the modern Hugues system was stated by Desnoyers (chief forest guard of the national forests of France) to be about one cent a year for each tree. To change from the American to the Hugues system it would not cost that much, for the cutting and cornering of the boxes, allowing two boxes to a tree and 1.4 cents for the cost of each box, amounts to nearly three cents for each tree the first year; and by the American practice one-fourth of the total yield of turpentine for six years is obtained during the first year. In the French orchards, on the other hand, the yield is very nearly the same for each year. The cups, which are made of glazed earthenware, have a hole near the upper rim which can be slipped over a hook or staple driven in the tree. Thick galvanized iron makes better gutters than zinc, as the former stands driving better and is much less injured by atmospheric influences. It is cut in strips four inches long and one and one-half inches wide, one of the longer sides being cut obliquely to the surface so that it can be easily driven into the sap-wood of the pine.

The above-mentioned facts concerning the tapping of the pine in France are taken from Samano's *Treatise on the Culture of the Maritime Pine;* Desnoyers' *Tapping of the Maritime Pine;* Prof. L. Boppe's *Forestry*, and *The Naval Store Industry* in the Report of the Chief of the Division of Forestry in the U. S. Department of Agriculture for 1892. This last mentioned publication has a very clear and concise account of the different methods of tapping, with the advantages and disadvantages of the different systems, and is well illustrated. It can probably be obtained free of charge by any one desiring to know more of the merits of the Hugues system and the condition of the naval store industry in other parts of the United States and in foreign countries.

CHAPTER IV.

THE LUMBER INDUSTRY IN EASTERN NORTH CAROLINA.

HISTORICAL SKETCH.

Until within the past two decades the production of lumber in eastern North Carolina, except for local use, had been small, owing to the great distance from general markets and the limited demand for the hard pines. Wilmington, as early as the middle of the last century, had considerable trade in long-leaf pine lumber with the West Indies and England, and this trade continued in a limited way until the first part of the present century, when with the use of steam in sawing the output was largely increased. Mr. James Sprunt, in his "*Information Concerning Wilmington, N. C.,*" says that the first steam saw-mill established in Wilmington was erected on the western side of the Cape Fear river by a person named Mazerretti in the year 1818.

For a great many years after this Wilmington had a large and growing trade in lumber with the West Indies, but of late years the competition of Savannah, Mobile and Pensacola, which are much nearer to these islands, has prevented any farther expansion of the industry in that direction. Wilmington has always had a large trade in lumber with the Middle and New England States, where the long-leaf pine has been largely used in ship-building, etc.

In the last few years, owing to the increased demand for Southern hard pine, the number and capacity of the mills at Wilmington have been more than doubled. The logs for supplying this demand come from the counties along the Cape Fear, Black and North East rivers and their tributaries, along which lie well-timbered cypress, long-leaf pine and loblolly pine lands. The territory drained by these streams is about 5,000 square miles, over one-fourth of which area is timbered with long-leaf pine that can be floated to Wilmington.

As early as 1830 both Newbern and Washington had large trades in long-leaf pine lumber with foreign ports, mostly in the West

Indies. By 1860, however, owing to the exhaustion of the long-leaf pine in these sections, their trade had ceased, and since that time these points have become centers for the production of loblolly pine lumber.

Loblolly Pine in the Timber Market.—As the supply of long-leaf pine became exhausted north of the Neuse river other pines were used in its place, the short-leaf pine being the next used and then the loblolly. In many sections these latter have always been the only pines available for building materials.

It is only within the past thirty years, however, that the loblolly pine has entered the general market in the form of lumber, being debarred, previous to that time, because of the fact that so large a proportion of it is sap wood. If used where exposed to the weather it decayed rapidly, and when used for interior work had to be painted, since it "blued" badly. The introduction of dry kilns, which enabled the sap to be thoroughly driven from the timber and the wood perfectly dried, has given it a wide range of uses. Now there is a steady demand for it, as it is extensively used for flooring, ceiling and other interior wood-work, and also for exterior work, for which latter use it is suitable only when thoroughly dried and painted. In the Northeastern States it is being used as a substitute for white pine and spruce, and as the better grades of these become scarcer and consequently more valuable the demand there for loblolly pine lumber increases and the uses to which it is put become more varied.

Since this is the chief timber tree over a large part of the State, it has been used for many years, in the section where it is the only pine, for building and fencing material. For these domestic uses only the largest stocks, and those with the most heart, were selected. For the manufacture of kiln-dried flooring and ceiling, however, those trees are preferred which have the least heart, since the sap wood furnishes a lumber more uniform in quality and color than the heart. Lumber made from the sap wood is also lighter than that from heart wood and the cost of transportation is less. It is marked in the New England and Middle States where it is sold under the name of "North Carolina pine," "North Carolina sap pine," or "North Carolina kiln-dried pine."

There has been a considerable increase in the value of loblolly pine stumpage since it has entered the general lumber market. Twenty years ago loblolly lands ranged in value from 50 cents to $1 per acre, according to situation in relation to transportation facilities and density of growth. Land similarly situated and timbered now sells from $1 to $5 an acre. Original growth loblolly lands will cut from 3,500 to 6,000 feet, board measure, to the acre; second growth from a third to a half less.

STATISTICS OF THE LUMBER INDUSTRY.

The statistics for this report on the saw-mill and forest industries of eastern North Carolina were collected in connection with an investigation of the timber lands of this section, which has just been completed. It is intended more to show the condition of the various branches of the lumber and allied industries, in respect to output and supply, than to give a general treatment of the different departments of the aggregated interests. In this connection there are but imperfect statistics for comparison, these being chiefly estimates prepared for lumber journals.

The area treated of embraces forty-three counties, which constitute the original "long-leaf pine belt" of North Carolina and to which, according to the U. S. Census of 1880, four-fifths of the milling interests of the State were at that time confined. In this enumeration are contained the products of all saw-mills and planing-mills, whether operated in connection with saw-mills or as distinct establishments, excepting entirely local planing-mills and door, sash and blind factories connected with these or distinct. There are in this section ten such local planing-mills and blind factories, which have an output with an estimated value of between $100,000 and $250,000 per annum. In spite of the fact that the latter half of the year 1893 was an era of business depression, and consequently there was a curtailed output, there is a marked increase shown in the value of the output of 1893 over that of both 1890 and 1880, according to the census reports for those years.

The value of rough and remanufactured lumber, including shingles, produced in this "long-leaf pine belt" of North Carolina for the year ending December 31, 1893, was about $4,559,000. For the census year 1880 it was $1,340,000, and for the census year 1890 it was, for the entire *State*, $5,767,687.

The output for 1893 came from 323 lumber-mills, including shingle-mills, with an aggregate capital of $4,690,000. The capital reported by the census, for the entire State, in 1890 was $5,319,500, invested in 688 establishments.

The capital engaged respectively in the manufacture of shingles and board cannot be separated, since the manufacture of shingles is largely engaged in by mills producing other lumber products. The number of mills engaged in the manufacture of lumber was 281, with an output in 1893 of 455,865,000 feet, board measure, valued at about $3,745,000. The number of shingle-mills was 65 (42 exclusively shingle-mills), with an output of 166,180,000 shingles, valued at about $813,280.

OUTPUT OF LUMBER AND SHINGLES.

The output of lumber and shingles and the capacity of the lumber and shingle-mills in operation in each county for the year ending December 31, 1893, was as follows:

Output of Lumber and Shingles, Eastern North Carolina, 1893.

COUNTIES.	Number of Establishments.	LUMBER.		SHINGLES.	
		Output in 1893, in feet, board measure.	Yearly capacity in 1893, in feet, board measure.	Output in in 1893.	Yearly capacity in shingles, 1893.
Bladen	5	2,800,000	5,400,000	3,500,000	5,000,000
Bertie	7	1,940,000	5,000,000	3,000,000	5,000,000
Beaufort	13	28,350,000	35,000,000	4,000,000	6,000,000
Brunswick	3	*2,000,000	3,500,000	.....	.....
Camden	5	4,500,000	6,000,000	1,300,000	4,000,000
Carteret	3	6,700,000	8,000,000	.....	.....
Chowan	6	24,400,000	30,000,000	3,000,000	4,500,000
Craven	16	46,700,000	53,500,000	12,300,000	15,800,000
Columbus	8	13,400,000	24,000,000	15,100,000	25,000,000
Cumberland	10	10,500,000	18,000,000	.....	.....
†Currituck	.....	.....	.....	.....	.....
Dare	5	*2,000,000	4,005,000	6,000,000	10,000,000
Duplin	6	1,800,000	3,000,000	.....	.....
Edgecombe	9	*2,850,000	4,000,000	1,500,000	3,500,000
Gates	6	2,700,000	4,500,000	780,000	1,600,000
Green	11	2,300,000	5,000,000	1,500,000	2,200,000
Halifax	5	*8,000,000	14,000,000	.....	.....
Harnett	5	6,800,000	8,500,000	.....	.....
Hertford	4	3,800,000	‡.....	2,500,000	4,500,000
Hyde	5	6,900,000	10,000,000	3,000,000	4,000,000
Johnston	7	*7,600,000	13,000,000	.....	.....
Jones	5	2,200,000	3,000,000	3,700,000	2,000,000
Lenoir	13	20,300,000	25,000,000	8,200,000	13,000,000
Martin	10	19,500,000	30,000,000	15,000,000	19,000,000
Montgomery	3	2,300,000	3,000,000	.....	.....
Moore	30	32,320,000	49,000,000	1,900,000	4,700,000
§ Nash	6	3,550,000	4,800,000	.....	.....
New Hanover	8	36,000,000	48,000,000	1,500,000	1,500,000
Northampton	5	*5,800,000	8,000,000	.....	.....
Onslow	3	14,500,000	16,000,000	.....	3,000,000
Pamlico	7	11,700,000	15,800,000	.....	800,000
Pasquotank	13	22,500,000	30,000,000	19,500,000	23,000,000
Perquimans	6	4,900,000	7,000,000	3,000,000	3,900,000
Pitt	10	7,000,000	10,000,000	3,000,000	4,500,000
Pender	5	900,000	1,500,000	3,300,000	4,800,000
Robeson	12	14.700,000	18,300,000	4,000,000	7,000,000
Richmond	12	12,000,000	17,500,000	1,700,000	3,300,000
Sampson	9	1,670,000	3,800,000	400,000	950,000
Tyrrell	3	4,500,000	6,000,000	7,000,000	9,000,000
Washington	6	34,500,000	40,000,000	27.200,000	32,000,000
Wake	9	6,000,000	10,000,000	2,000,000	2,800,000
Wayne	6	8,600,000	10,000,000	300,000	1,800,000
Wilson	3	1,500,000	2,800,000	.....	.....
Totals	323	452,880,000	625,000,000	159,180,000	208,150,000

The figures show the quantity of lumber manufactured in each county rather than the amount cut in each. In some cases logs were carried to large mills from several adjoining counties, and are here credited to counties where sawn.

*Partly estimates made by lumbermen. †No reports made. ‡Mills destroyed before the end of the year. §Reports incomplete.

The output is at least one-tenth less than it would have been under normal trade conditions, since 107 mills, with an output of 230,000,000 feet, board measure, reported an average idleness of seven weeks. Many mills also that did not shut down considerably reduced their output during a part of the year. The unprecedented freeze during the month of January, 1893, caused many mills dependent upon the water-courses for their supply or operation to shut down for several weeks. The output would otherwise have been over 500,000,000 feet.

In the preceding statement the output for the respective counties does not necessarily mean that the timber was produced in them, but merely that it was manufactured in these counties. Camden, Chowan and Perquimans counties now produce but a small proportion of the timber manufactured in them; it comes from Bertie, up the Chowan river, and the counties lying on the southern side of Albemarle sound.

The proportion of timber produced by individual counties is more nearly represented by a subsequent table showing the amounts of timber and timbered lands held by logging and milling companies in each county, though there are given no actual figures of the production of timber by counties. There are only a few towns in the State which have a large annual output, the mills in general being scattered through the timbered districts.

The relative rank, capital invested, yearly capacity, output and value of output of the three producing points, for 1893, were as follows:

Capital, Output, etc., at Different Lumber Markets in Eastern North Carolina, 1893.

Towns.	Rank.	No. of establishments.	Capital.	Output for 1893, feet, board measure.	Yearly capacity.	Value of output, 1893.
Wilmington	1	8	$530,000*	36,000,000	48,000,000	$425,000†
Newbern‡	2	9	385,000	38,000,000	51,000,000	350,000
Washington	3	7	165,000	21,000,000	27,000,000	188,000

*Not full, partly based on a bulletin of the U. S. Census of 1890.

†Partly taken from the custom-house records of Wilmington.

‡Includes James City, a village on the opposite side of the Trent river.

The apparent disproportion between capital and value of output in the various statements is due to the different extent to which remanufacturing is carried at different places. Wilmington, too, largely increased during 1893 the capital engaged there in milling, but not sufficiently early in the year to increase the output in like ratio. The output of no shingle-mills or remanufacturing establishments except such as are connected with lumber-mills is included in the above. Elizabeth City and Edenton, with twelve mills, had a combined output of 38,000,000 feet, board measure, and 21,000,000 shingles. The shingles made in these places were largely from juniper or white cedar; the lumber was chiefly made from the loblolly pine. All except a small part of the output of Wilmington was from long-leaf pine, that of Newbern and Washington was largely loblolly pine, less than five per cent. being long-leaf. The Aberdeen district in Moore county, and the western part of Cumberland county produced in 1893 over 31,000,000 feet of long-leaf pine.

LUMBER PRODUCT FROM DIFFERENT SPECIES OF TREES.

The output in eastern North Carolina, 1893, of lumber and shingles was distributed according to kind of tree as follows:

Lumber Product from Different Kinds of Trees, 1893.

KIND OF TIMBER.	Lumber, thousand feet, board measure.	Shingles.
Loblolly pine*	288,000	....
Long-leaf pine	148,600	10,300,000
Cypress	6,275	111,680,000
Juniper (white cedar)	6,300	44,200,000
Ash	5,000	....
Yellow poplar†	2,400	....

*The savanna and short-leaf pine were sawn along with the loblolly and not distinguished from it, so there was no way of getting any accurate information about the quantity of these that was sawn. The savanna pine formed a large part of the material sawn at some mills in the extreme east, but there was no appreciable amount of short-leaf pine sawn except along the western boundary of the pine belt. Loblolly pine was reported as being sawn in thirty-three counties, and in twenty of these no long-leaf pine was sawn. Long-leaf pine was sawn in twenty-one counties and entirely sawn to the exclusion of the loblolly pine in six counties. The counties which produced the most loblolly pine were Beaufort, Bertie, Columbus, Craven, Dare, Gates, Halifax, Hertford, Jones, Lenoir, Martin, Onslow, Perquimans and Washington. Those which produced the most long-leaf pine were Cumberland, Moore, Richmond, Sampson and Robeson counties.

†Including small quantities of persimmon, sweet-gum, oak and dogwood.

Of the above amounts of lumber sawn there were 138,420,000 feet remanufactured at the mills, of which 101,420,000 feet were of loblolly pine and 37,000,000 feet were long-leaf pine. Besides this it is estimated that there were 45,000,000 feet of both kinds remanufactured at separate establishments in Moore, Richmond and Perquimans counties.

The amount of lumber used locally, including that shipped to other points in North Carolina, was 79,200,000 feet, of which 52,000,000 feet was long-leaf pine lumber. It seems that long-leaf pine lumber is much more widely used in the State than that made from the loblolly pine. This is because the long-leaf pine timber lasts so much longer than that of other pines when used in exposed situations, as is generally the case in this State. Most of the loblolly pine used in North Carolina is sawn in the counties where it is used. What is exported goes to the Northeastern States, about the same amount going by rail as by water. The long-leaf pine lumber, except that from Wilmington, goes to Virginia, Pennsylvania, and other interior States. That from Wilmington goes to coastwise ports and to the West Indies.

LUMBER SHIPMENTS FROM WILMINGTON.

The total shipments of lumber, the foreign exports and the value of the latter, from Wilmington for the years 1873, 1883 and each year of the past decade were as follows:

Quantity and Value of Lumber Shipped from Wilmington, 1873–'93.

YEAR.	*Total shipments of lumber, feet, b. m.	†Total foreign exports of lumber, feet, b. m.	†Value of foreign exports of lumber.	YEAR.	*Total shipments of lumber, feet, b. m.	†Total foreign exports of lumber, feet, b. m.	†Value of foreign exports of lumber.
1873	19,517,768	6,920,171	$............	1888	41,067,686	13,019,000	$190,681
1883	40,281,158	9,074,077	....	1889	36,679,509	10,695,000	172,487
1884	37,076,042	15,319,000	232,537	1890	40,289,205	13,824,000	212,094
1885	35,956,829	14,912,000	238,983	1891	40,065,567	17,532,000	287,448
1886	39,512,249	9,053,000	145,968	1892	29,580,160	12,224,000	174,446
1887	....	11,190,000	174,121	1893	25,874,331	13,244,000	175,699

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*From the records of the Wilmington Board of Trade. For the compilation of these figures and others obtained from these records the Survey is indebted to Col. J. L. Cantwell, Secretary of the Wilmington Board of Trade. These figures indicate the number of feet in board measure.

†From the custom-house records.

PRODUCTION AND EXPORT OF SHINGLES.

The greater part of the sawn cypress shingles, and all of the first-class white cedar (juniper) shingles manufactured in the State, have been exported. The greater part of the pine shingles have been used locally. Wilmington was the only point in the State that has shipped any shingles to foreign ports. It also had a large domestic trade. The total exports of shingles from Wilmington, the foreign exports, and the value of the foreign exports for the years 1873, 1883, and each year of the past decade are shown by the following table:

Quantity and Value of Shingles Exported from Wilmington, 1873–'93.

YEAR.	Total Exports.	Domestic Exports.	Foreign Exports.	Value of Foreign Exports.
1873	6,338,836	3,960,580	2,378,256	$..................
1883	6,635,851	4,748,951	1,886,900	....
1884	10,140,707	6,510,707	3,630,000	18,936
1885	7,191,335	3,894,335	3,297,000	18,936
1886	9,265,560	7,677,560	1,589,000	8,749
1887	5,726,453	3,499,453	2,227,000	11,750
1888	6,663,950	2,622,950	4,041,000	21,125
1889	7,316,912	3,593,912	3,723,000	17,946
1890	8,935,064	5,305,064	3,630,000	19,249
1891	5,958,520	3,732,520	2,226,000	12,930
1892	10,274,329	7,358,329	2,916,000	15,519
1893	18,167,500	6,314,500	1,853,000	9,806

Much the larger part of the shingles shipped from Wilmington are hand-drawn or rived cypress shingles. These are made entirely in the surrounding counties, especially those along the Cape Fear river. The making of drawn shingles, both from cypress and long-leaf pine, is an industry that has rapidly declined during the past decade. Estimates given by shingle dealers at Wilmington, Newbern and Washington, and smaller places along the seaboard, show a falling off in the production of one-half or more since 1880. This falling off is largely due to the fact that the supply of the best quality of cypress which could be easily reached in the swamps has been in a measure exhausted. The number of rived pine and cypress shingles estimated to have been made last year (1893) was 22,800,000, valued at about $55,000.

CAPITAL INVESTED IN THE LUMBER INDUSTRY.

The capital reported as invested in milling was $4,690,000. This was engaged as follows: In milling plants, stock and live assets, $3,471,100; in timber lands, $817,432; in railroads and rolling stock, $408,800. Seventy-four establishments reported that they owned or controlled 630,760 acres of timbered land. Of this 298,700 acres were loblolly pine lands, 219,200 acres were white cedar (juniper) swamp, 89,800 acres cypress and gum swamps, and 24,000 acres long-leaf pine lands. About 300,000 acres of this, including the cypress and white cedar land, is owned, and the rest is controlled for a limited number of years.

The registers of deeds of ten counties reported $158,934 invested in timber lands in their respective counties, by logging or milling companies of other States. This represented 114,995 acres of land. The swamp land amounted to 51,230 acres and the loblolly pine lands to 63,765 acres. In this connection was also reported 20,000,000 feet of standing loblolly pine, valued at $22,000. This was situated in Gates, Hertford and other north-eastern counties. Bulletin No. 5 of the U. S. Census of 1890 reported 111,418 acres of yellow pine and cypress land, with an estimated total product of 953,770,000 feet, board measure, of merchantable timber, and a value of $346,885, to be owned in North Carolina by milling establishments located in Michigan and Wisconsin.

The $408,800 invested in railroads and rolling stock represents eighteen roads, with 194 miles of track and their necessary equipment. Besides this there are eight railroads exclusively or largely engaged in handling lumber and timber, which had 96 miles of track, and were taxed in 1893 on a valuation of $256,300.

The capital reported as invested by millmen in lumbering does not by any means represent the total amount of capital engaged directly or indirectly in milling. Forty-two establishments reported 171,800,000 feet, board measure, of their logs as having been brought to the mills by outside capital. This is 31 per cent. of all the logs brought to the mills. The number of persons engaged in handling this timber, taking them to be 45 per cent. of those engaged in logging, in the employment of the mills, was 1,300.

This, with the total number reported as employed by milling companies in logging, makes 2,800 engaged in this branch of the industry. The total number of hands reported as employed in the entire industry, in handling the material from the stump to the finished product, was 8,320.

The rafting of timber to the mills is done by farm laborers during the dull seasons of the year. The price paid at the mills for this timber is from $3.75 to $5 a thousand feet, board measure, for loblolly pine, and from $3 to $6 for cypress and ash, according to the quality of the timber and situation of the mill. Long-leaf pine brings the same prices as loblolly pine.

THE PRODUCTION OF LUMBER IN NORTH CAROLINA IN 1893.

Exports of Crude Lumber.—There were operating in North Carolina in 1893 three timber companies, with a capital of $40,000, reported as engaged in logging for establishments in other States. During the year 1893 there were exported by these and other logging and milling companies logs amounting to about 110,000,000 feet, board measure, to establishments in other States. This amount exported was nearly one-fourth the entire amount manufactured in the State. It consisted mostly of loblolly pine, with some cypress, and had an estimated value in raft in this State of $500,000. It went out by way of the Chowan river, and through the Dismal swamp canals and partly by rail. This timber was manufactured chiefly at Franklin, Whaleyville, Suffolk and in the vicinity of Norfolk, Va. Besides this there was exported 9,800 cords of white cedar billets, valued at $62,000, chiefly to Philadelphia, Richmond and Norfolk. This, however, cannot begin to represent the total amount shipped, since the white cedar was shipped in small amounts from a great many different places, so that but little knowledge could be gained from these sources about the amounts shipped and their value.

Recent Growth of the Lumber Industry.—An endeavor was made to ascertain the increase of capital invested in milling and the increase in output since 1890, and also to find the amount of increase during 1893. While the number of new plants erected since 1890 was gotten, the capital invested in those that had stopped running or indefinitely suspended, and their annual output could not be accurately ascertained. The following table represents, however, very nearly the increase since 1890 in capital, annual shingle and board capacity for mills sawing long-leaf and loblolly pine and cypress lumber:

Increase Since 1890 in Capital and Productive Capacity of Lumber Mills.

	New Establishments.	Capital Invested.	Board Capacity, in feet.	Capacity in Shingles.
Loblolly pine and Cypress.....	18	$1,011,300	85,000,000	38,000,000
Long-leaf pine	14	73,000	28,000,000	2,000,000
Totals........................	32	$1,084,300	113,000,000	40,000,000

It was also ascertained that in this same time about twenty plants, with an annual output of 25,000,000 feet, had ceased running. The above increase in loblolly pine mills lay largely in Washington, Onslow, Martin, Lenoir, Halifax, Craven, Columbus and New Hanover counties, and in long-leaf mills in Moore, Nash and Cumberland counties.

The total increase in capital for the year 1893 was $392,000, and in yearly capacity was 46,000,000 feet.

There was besides this an increase for 1893 of twenty miles of logging railroad, valued, with the rolling stock, at $80,000.

MISCELLANEOUS WOOD-WORKING INDUSTRIES.

There are several minor industries in eastern North Carolina which are largely or entirely dependent upon timber for their products and which annually consume large amounts of timber or wood.

One of the most important of these industries is that engaged in the manufacture of cooperage. The stock establishments engaged in the manufacture of cooperage in North Carolina during 1893 are situated chiefly in the eastern part of the State, and included three barrel factories making truck barrels and boxes, with an output of 53,000 barrels and 1,790,000 staves, valued at $22,000; two bucket factories using white cedar; and a great number of small cooperage concerns engaged in making casks for spirits turpentine from oak, and barrels for rosin and crude turpentine from pine. The barrels for truck were made partly from pine "slabs," with wire hoops, and partly from black-gum staves with cypress hoops and yellow poplar heads.

Besides this there was a large amount of cooperage material, staves, headings and hoops, manufactured in Washington, Dare and other north-eastern counties from cypress and white cedar. The census for the year 1890 reports that there were that year eighty-three establishments manufacturing cooperage in North Carolina, with a capital of $34,542 and an output valued at $111,925.

There are a number of special manufactories in the State, including veneer works, spoke and handle factories, etc., using nothing but wood in the manufacture of their products, or largely dependent on wood. The character and extent of these manufacturing establishments and the practicability of increase in the State will be made the subject of a special Bulletin to be published by the Survey at an early date.

PRODUCTION OF TIMBER OTHER THAN MILL TIMBER.

"TON TIMBER."—The forests of eastern North Carolina once furnished a large quantity of very valuble pine stocks of exceptionally large size and superior quality, under the name of "ton timber," which were used in naval architecture, and for other purposes requiring extra large strong timbers. These stocks came from both the loblolly and long-leaf pines, the former furnishing the longest and largest pieces. The finest trees for these uses have been removed wherever accessible, and though some of these stocks are still gotten out each year their size is not so large and their quality is not so high as formerly.

During recent years the largest of these stocks have come from up the Cape Fear river, being that growth of loblolly known as rosemary pine. They are procured here and there, only a few at a place, in separate localities, by a number of contractors, so that reliable information as to the amount of production could not be obtained. However, at least 20,000 feet, scale measure, were exported last year to coastwise and to European ports. A larger quantity of this timber was shipped from Wilmington than from any other point.

RAILROAD TIES.—One of the most constant demands for the best heart pine and young white and post oaks is for making railroad cross-ties. The eastern part of this State not only furnishes all the timber required for the construction and maintenance of its own lines of railroads, but annually exports several thousand cross-ties to other States. There are about 400,000 cross-ties required yearly to maintain the existing lines of railroad. Of these 400,000 ties about one-half are all-heart long-leaf pine, and average about 7½ feet long by 9 inches broad and 6 inches thick, each containing about 3 cubic feet of wood. The oak ties are larger, especially broader, and are being used more than formerly. There are some cypress and a few white cedar ties in use, and on some roads loblolly pine ties are used. The average price paid for hewn ties is about 22 cents each. As near as could be ascertained there were 22,000 white cedar and cypress, and 30,000 pine ties, exported during the year 1893.

TELEGRAPH POLES, ETC.—These are cut from both cypress and white cedar woods. About 7,000 poles are annually required for use in this State, and besides this about 12,000 white cedar telegraph and electric light poles, valued at about $27,000, were shipped during 1893. The requirements for such white cedar poles usually are that they shall have few knots in them, and very few are cut under 14 inches in diameter at the larger end, so that the finest stocks are required to make them. It would be advisable for more care to be taken of juniper "bays" and swamps after they have been lumbered. Their soil is generally too peaty to be used for agricultural purposes, so that the only real use to which these lands can be put is to let grow on them the young white cedar left after they are cut over. Precaution should be taken to prevent these swamps from being burnt over, during dry seasons, as the forest fires not only destroy the young growth of white cedar, but also burn the thin layer of organic matter, consisting of sphagnum, peat and buried cedar logs, clear down to the sand subsoil, and thus destroy the possibility of a future supply of this timber.

THE PRODUCTION OF OAK STAVES.—From 1840 until 1880 there were annually made in the north-eastern counties many thousand white and red oak staves. During the last fifteen years, however, this industry has declined to a very small part of what it once was. Staves were very largely shipped from Beaufort county to the West Indies, prior to 1860. "Red oak staves" made from black, scarlet, water and spanish oaks were preferred for this trade; while for the European trade, which went by way of Norfolk, New York or Baltimore, "white oak staves" were preferred. The latter were made from white oak, post oak and overcup oak. Between 1868 and 1880 the counties around Albemarle sound produced large numbers of staves, but the practical exhaustion of the best accessible oak has largely reduced their output. Nash county now produces a considerable number of oak staves, and this is the only county in the eastern section of the State that does. Further west, however, large quantities of such staves are made in the upland oak forests which extend through the middle and western parts of the State to Tennessee.

AGGREGATE VALUE OF THE FOREST PRODUCTS OF EASTERN NORTH CAROLINA.

The values of all the timber and lumber products of eastern North Carolina for 1893 may be said to have been as follows:

Value of lumber, including sawn shingles	$4,558,280
" " round timber exported	562,000
" " "tun" and hewn timber exported	12,000
" " railroad ties produced.	110,000
" " telegraph and electric light poles	27,000
" " hand-made shingles	55,000
" " products of special manufactories (U. S. Census, 1890),	131,055
" " cooperage products (U. S. Census, 1890)	111,925
Total	$5,567,260

To this amount can be added the value of all resinous products, which amounted, in 1893, to $1,752,760; and we have as the approximate market value of the forest products for eastern North Carolina in 1893, $7,320,020. This does not show the real total value of the forest products of this section, since practically all the fencing material is wood, and over nine-tenths of the fences are made from rails manufactured on the farms and not included in the above amounts. Neither is there included in the above any of the fire-wood, which constitutes nearly all of the fuel used in this section, both for manufacturing and domestic purposes. The value of the fencing cut up, and the cord wood in piles, would amount to considerably over $4,500,000 a year, for the quantity of both consumed in eastern North Carolina, and this added to the value of the other products, makes an aggregate value of about $12,000,000 for the forest products of this section, for one year. This makes the forest industry one of the largest in the State. The cotton crop of the entire State had in 1890 a value about equal to this amount.

RECENT TIMBER DEVELOPMENTS, AND THE OUTLOOK.

The tendency of the lumber industry in North Carolina is towards larger establishments, turning out at the mills as highly finished a product as possible, such as flooring, ceiling, moulding, etc. The wisdom of this course is fully sustained by the fact that there were in these eastern counties, in 1880, 306 establishments, which had an output valued at $1,340,000; while in 1893 there were only 323 establishments, with an output of $4,559,000. There are now in operation nine band saws, five of which have been put in since 1890; and the change from circular to band saws is being contemplated by several other establishments, since there is a saving in them, not only of motive power, but also a great saving of timber.

Most large mills which will be built in the future, at least those for sawing loblolly pine, will be furnished with band saws.

The next ten years will probably show a much greater increase in milling than the past decade, and a very much larger development of the loblolly pine and hardwood industry. There are several counties in which the loblolly pine has as yet no commercial value, and in which it is only sawn in small quantities for local use. The fact that the mills using this kind of timber, and owning timber land, reported over 2,000,000,000 feet in sight, insures them sufficient material for many years to come. Besides this, the area still unlumbered and not controlled by lumber men, must have at least twice as much standing timber on it as was reported by millmen for their lands. This does not include any regrowth which is now occupying areas already lumbered.

USES OF THE IMPORTANT WOODS IN EASTERN NORTH CAROLINA.

The *long-leaf pine* serves for more uses than any other tree of this section. Its largest uses are for heavy building material for houses, bridges, trestles and other places where great strength and length of timber are required; for tank plank, flooring, ceiling, weather-boarding, shingles, railroad cross-ties, and filing. Its special qualities as a wood are not yet sufficiently understood by consumers, and it is put to a great many uses to which an inferior and weaker timber might as well be applied. Its use as tank plank is one to which it has only lately been extensively put, but one to which it is well adapted on account of its durability. It is extensively used for fencing and posts, and in the form of split rails, throughout all the south-eastern section of this State.

The *loblolly pine* is manufactured chiefly into flooring and ceiling, and to some extent into scantling for frame work, bridge timber, etc. For the last uses the wood is not so well suited as that of the long-leaf pine, though it is extensively used when the long-leaf cannot be gotten. Railroad cross-ties are made from it in the north-eastern counties, but they decay rapidly, since they are largely or entirely of sap wood, and are in contact with a soil unusually damp during the greater part of the year.

The *short-leaf* and *savanna pines* have the same uses as the loblolly, though the wood of both trees is different from that of the loblolly. The loblolly pine is also largely used for fencing.

The *yellow poplar* is manufactured into boards for box stuff, and some of the best quality of lumber into furniture squares. The poplar of the eastern swamps, however, is of an inferior quality when compared with that from the western part of the State, and can only be put to secondary uses. It makes excellent fencing.

Ash is sawn into furniture squares, banister and newel post pieces, and some of the lower grades of wood into boards. Barrel hoops are extensively made from it. Like the poplar its quality is not as high as the ash from the western counties.

White cedar (juniper) is now recognized as one of the most valuable woods of the eastern United States, and decidedly the most valuable in the eastern part of North Carolina, where it has a large and constantly increasing number of uses. It is employed for making cooperage ware, pails, tubs, railroad tank plank and boat plank, shingles, sashes, railroad ties, telegraph and telephone poles and for fencing. All of these services to which it is put are based on the property it possesses of withstanding exposure to moisture, or alternate wetting and drying, and its small shrinkage. In this State it is also used in the manufacture of cheap furniture, and is said to be particularly suited for such, being easily worked, shrinking very little, and being light.

Cypress is largely used for shingles, and in other ways in which white cedar is used. Besides, on account of its great size, wide paneling, wainscoting and building material, sashes, blinds, exterior mouldings, and other wood-work exposed to the weather, are made from it. The poorer quality wood, where it is worm-eaten and "peggy," is sawn into fence boards.

The uses reported for the other woods were very few, and indeed very little of them is being sawn. Some *sweet-gum* is sawn into lumber for making furniture, but it warps so badly that it is difficult, even when kiln-dried at once, to get good boards for shipment. A use for which it is well adapted is to make veneer ware, butter and lard dishes, crates, small baskets, etc., and it is being largely employed in such manufactures in the eastern section. For making the veneer, the gum logs are cut to a uniform length, steamed thoroughly to soften the wood, placed in a large turning lathe the chisel of which takes off a thin sheet of wood as broad as the log is long. The chisel is moved automatically nearer to the center of the log with each revolution of the latter to make the sheet taken off of a uniform thickness. These sheets are then cut to size and pressed or bent into the shape desired, and steam-dried to prevent any warping.

The *black-gum* is being used for making staves and crates for use in trucking, for which uses manufacturers say it is well suited, not being heavy, and about the cheapest material that can be gotten.

Several thousand feet of *maple* was reported by one company among their products as being sawn for use in finishing the interior of railroad cars.

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ERRATA.

Page 22, line 14 from top; read *appressed* for *oppressed*.
Page 28, line 7 from top; read *compact* for *large*.
Page 31, line 19 from bottom; read *unlumbered* for *untimbered*.
Page 33, line 9 from top; read *exploitation* for *exploration*.
Page 38, line 18 from bottom; read (p. 32) for (p. 20).
Page 42, line 12 from top; insert *annually* after *and there is*.
Page 50, line 8 from top; read *occur* for *occurs*.
Page 118, line 16 from bottom; read *tun* for *ton*.

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